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ARTS

THE EMERGENCE AND DEVELOPMENT OF WOODWIND INSTRUMENTS IN EUROPE

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Abstract

This article examines the emergence and development of woodwind instruments in Europe from antiquity to the nineteenth century, using a historical and organological perspective. It traces early origins in ancient Greek and Roman cultures, where reed pipes and flutes served ritual, civic, and entertainment functions, and follows their transformation through the Middle Ages, Renaissance, Baroque, Classical, and Romantic periods. Particular attention is given to changes in instrument construction, sound production, and performance context, highlighting how advances in craftsmanship, acoustical understanding, and key mechanisms expanded technical and expressive possibilities. The study also considers social and institutional influences, including court patronage, the rise of public concerts, and the standardization of orchestral practice. By synthesizing established scholarship, the article demonstrates that the evolution of European woodwind instruments reflects a complex interaction between musical aesthetics, technological innovation, and cultural change, underscoring their enduring significance in Western music history.

Keywords: Woodwind instruments; European music history; organology; instrument development; orchestral evolution; musical technology

Introduction

Woodwind instruments occupy a distinctive position in the history of European music due to their versatility, expressive capacity, and long-standing presence across social, religious, and artistic contexts. Broadly defined, woodwind instruments produce sound through the vibration of air within a tube, typically initiated by a reed (single or double) or by directing air against an edge, as in flutes. Although many modern woodwinds are no longer made exclusively of wood, their classification is rooted in this acoustical principle rather than material composition [1].

The emergence of woodwind instruments in Europe cannot be understood in isolation; it is closely linked to earlier musical traditions from the ancient Mediterranean, the Near East, and Asia. Archaeological and written evidence suggests that reed pipes and flutes were among the earliest melodic instruments used by humans, serving ritualistic, communicative, and entertainment purposes [7]. In Europe, these early forms were gradually adapted to local musical systems, climates, and cultural practices, leading to a wide variety of indigenous woodwind instruments by the medieval period.

Throughout European history, woodwind instruments have reflected broader transformations in musical aesthetics and social organization. During the Middle Ages, they were often associated with outdoor performance, civic ceremony, and popular dance, while vocal music dominated sacred contexts. The Renaissance brought a shift toward balance and polyphony, encouraging the refinement of woodwind construction and the development of instrument families capable of ensemble performance [8]. Later periods further expanded the technical and expressive possibilities of woodwinds, aligning them with the rise of instrumental music as an independent art form.

Scholars of music history and organology emphasize that the development of woodwind instruments was driven not only by artistic ambition but also by technological innovation, including advances in woodworking, metallurgy, and acoustical knowledge [6]. These changes enabled greater pitch accuracy, extended range, and dynamic control, making woodwinds integral to the evolving European orchestra. By tracing the emergence and development of woodwind instruments, this article seeks to highlight how musical instruments function as cultural artifacts, embodying the artistic values and technical capabilities of their time.

Methods

This study employs a qualitative historical research methodology grounded in musicology and organology to examine the emergence and development of woodwind instruments in Europe. Rather than generating new empirical data, the article synthesizes existing scholarly literature to provide a structured and interpretive overview of long-term instrumental evolution.

Primary emphasis is placed on secondary sources, including academic books, peer-reviewed journal articles, encyclopedic reference works, and critical editions of music history texts. These sources were selected based on their scholarly credibility, frequency of citation, and relevance to European instrumental development. Foundational works in organology were used to clarify instrument classification, construction techniques, and acoustical principles, while broader music historical studies provided cultural and stylistic context.

The analysis follows a chronological framework, dividing European history into major periods (Antiquity, Middle Ages, Renaissance, Baroque, Classical, and Romantic eras) [10]. Within each period, woodwind instruments are examined according to:

- structural design and materials,
- sound production mechanisms,
- performance contexts (e.g., court, church, military, public concert),
- and compositional usage.

A comparative approach is also applied to identify continuities and changes between instrument types (such as the shawm and oboe, or the chalumeau and clarinet) and between regional traditions within Europe. This allows for the identification of developmental patterns rather than isolated innovations.

To strengthen interpretation, the study integrates contextual analysis, relating changes in woodwind instruments to broader social and technological factors, including the rise of professional musicians, advances in craftsmanship, the growth of orchestras, and shifts in musical aesthetics. While iconographic and archaeological evidence is referenced indirectly through existing scholarship, the article does not involve original examination of artifacts.

Overall, this methodological approach prioritizes historical coherence, interdisciplinary insight, and critical synthesis, aiming to present a clear and academically grounded account of how woodwind instruments evolved within European musical culture.

Results

Early Origins: Antiquity and the Middle Ages

The earliest European woodwind instruments show strong connections to ancient civilizations of the Mediterranean. In ancient Greece, the *aulos*—a double-reed instrument often played in pairs—was widely used in religious rituals, theatrical performances, and athletic events [12]. Similarly, end-blown and transverse flutes were present in both Greek and Roman cultures, with Roman military and civic life further disseminating these instruments across Europe [1]. By the Middle Ages, instruments such as the recorder, pipe, and shawm were firmly established.

During the Middle Ages (c. 500–1400), woodwinds were commonly used in outdoor and ceremonial contexts. Instruments such as the recorder, shawm, and simple transverse flutes were widespread. These instruments were generally loud and robust, suitable for open-air performance, and were often associated with dances, processions, and signaling rather than refined indoor music [5].

The Renaissance: Refinement and Consorts

The Renaissance period (c. 1400–1600) marked a significant step in the development of woodwinds. Instrument makers began producing families of instruments in different sizes, allowing for ensemble playing known as consorts. Recorders, shawms, and early flutes were carefully crafted to blend in polyphonic textures. During the Renaissance, woodwind instruments underwent significant refinement as musical aesthetics shifted toward balance, blend, and polyphony. Instrument makers began producing complete families of woodwinds in graduated sizes, enabling ensemble performance across different pitch ranges. Recorder consorts were especially prominent in domestic and courtly settings, while shawms continued to be used for louder ceremonial music [8].

Technical improvements included more precise boring of instrument bodies and experimentation with finger holes to improve tuning [9]. Woodwinds became increasingly accepted in courtly and domestic music-making, reflecting the Renaissance emphasis on balance, proportion, and expressive nuance.

The Baroque Era: Specialization and Expression

In the Baroque period (c. 1600–1750), woodwind instruments became more specialized and expressive. The shawm evolved into the oboe, which had a narrower bore and a more controlled, lyrical sound [2]. Similarly, the dulcian developed into the bassoon, providing a stable bass voice for ensembles and orchestras.

The transverse flute gained prominence, especially in France and Germany, and was favored for its dynamic flexibility. Composers such as Johann Sebastian Bach and Georg Philipp Telemann wrote extensively for woodwinds, integrating them into orchestral and solo repertoire [4]. Standardization of instrument design began, although variations between regions remained common.

Classical and Romantic Periods: Technological Advancement

The Classical (c. 1750–1820) and Romantic (c. 1820–1900) periods brought major technological changes. The addition of keys to woodwind instruments expanded their chromatic capabilities and improved intonation [6]. The clarinet, developed from the chalumeau, emerged as a major orchestral instrument during this time.

In the 19th century, innovations such as Theobald Boehm's key system revolutionized flute design and influenced other woodwinds [3]. Instruments became louder, more reliable, and better suited to large concert halls. The saxophone, invented by Adolphe Sax in the 1840s, represented a new member of the woodwind family, blending characteristics of brass and reed instruments. This period also witnessed the invention of entirely new woodwind instruments, most notably the saxophone, patented by Adolphe Sax in 1846. Designed to bridge the tonal gap between woodwinds and brass, the saxophone found early use in military bands and later in orchestral and popular music contexts [11]. By the end of the 19th century, woodwind instruments had become indispensable components of the modern orchestra, capable of meeting the expressive and dynamic demands of large concert halls.

Discussion

The historical development of woodwind instruments in Europe illustrates a dynamic relationship between musical expression, technological innovation, and social change. Rather than evolving in isolation, woodwinds responded continuously to the demands of composers, performers, and audiences, reflecting broader shifts in European musical culture. Organological studies demonstrate that changes in bore design,

key mechanisms, and materials were closely linked to evolving aesthetic ideals, such as clarity in Renaissance polyphony or expressive contrast in Baroque and Romantic music [1].

One of the most significant themes in the development of woodwind instruments is the gradual transition from functional and outdoor use to refined indoor performance. Medieval instruments such as shawms and simple flutes were primarily valued for their volume and durability, making them suitable for civic ceremonies and dance. By contrast, Baroque instruments like the oboe and transverse flute were designed to meet the expressive needs of chamber and orchestral music, emphasizing tonal flexibility and dynamic nuance [2]. This shift parallels the increasing importance of instrumental music as an independent art form rather than a subordinate accompaniment to vocal genres.

Technological innovation played a decisive role in shaping modern woodwind instruments. The introduction and expansion of key systems in the 18th and 19th centuries allowed performers to play in all keys with greater accuracy, supporting the harmonic complexity characteristic of Classical and Romantic compositions. The Boehm system, in particular, reflects the application of scientific principles to instrument design, marking a departure from tradition-based craftsmanship toward acoustically informed standardization [3]; [6]. These developments also contributed to greater uniformity across European orchestras, facilitating the international circulation of musicians and repertoire.

Social and institutional factors further influenced woodwind development. The rise of public concerts, conservatories, and professional orchestras in the 18th and 19th centuries created demand for reliable, standardized instruments and consistent playing techniques. At the same time, military bands and civic ensembles played an important role in popularizing certain woodwinds, including the clarinet and saxophone, beyond elite artistic circles [11]. This dual presence in both high art and popular contexts underscores the adaptability of woodwind instruments within European society.

Despite increasing standardization, regional traditions and historical performance practices have remained significant. The 20th-century early music revival renewed interest in pre-modern woodwind instruments and playing styles, emphasizing historical authenticity and craftsmanship. Scholars argue that this movement highlights the importance of understanding woodwind instruments not merely as technical objects but as cultural artifacts embedded in specific historical contexts.

In summary, the development of woodwind instruments in Europe represents a complex interplay of artistic intention, technological progress, and social structure. Their enduring evolution demonstrates how musical instruments both shape and are shaped by cultural values, ensuring their continued relevance across changing musical landscapes.

Conclusion

The emergence and development of woodwind instruments in Europe reveal a rich and multifaceted history shaped by cultural, technological, and musical forces. From their early use in ancient ritual and medieval civic life to their central role in the modern orchestra, woodwinds have continually adapted to changing artistic demands. Advances in craftsmanship and acoustical knowledge transformed simple pipes and reeds into highly sophisticated instruments capable of great expressive range and technical precision. At the same time, shifts in social structures—such as the rise of courtly patronage, public concerts, and professional music institutions—encouraged both innovation and standardization. Despite these changes, regional traditions and historical performance practices have preserved the diversity of woodwind forms and sounds. Ultimately, the study of woodwind instruments highlights how musical tools function as cultural artifacts, reflecting broader historical processes while actively shaping the development of European musical expression across centuries.

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BIOLOGICAL SCIENCES

EFFECTS OF TOBACCO SMOKING ON DRUG PHARMACOKINETICS AND CHANGES AFTER SMOKING CESSATION

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Abstract

Tobacco smoking remains a prevalent habit worldwide and has been demonstrated to significantly influence the pharmacokinetics and pharmacodynamics of many medications. Through induction of hepatic cytochrome P450 enzymes — particularly CYP1A2 — constituents of cigarette smoke accelerate clearance of drugs, often leading to sub-therapeutic plasma concentrations and reduced efficacy in smokers. Our 6-month observational simulation explores how stable doses of CYP1A2-substrate drugs behave in active smokers, and how these parameters shift following smoking cessation without dose adjustment. Based on aggregated literature data and enzyme-activity patterns, we model that smokers maintain 30–70 % lower systemic exposure to such drugs compared to non-smokers, while after cessation — as CYP1A2 activity normalizes — identical dosages lead to significantly increased plasma concentrations, risking toxicity. These findings underscore the critical need for dose re-evaluation and therapeutic drug monitoring when a patient's smoking status changes. Personalized dose adjustment during and after smoking cessation is recommended for medications metabolized via smoking-sensitive pathways.

Keywords: Tobacco smoking, drug metabolism, CYP1A2, smoking cessation, drug–smoke interactions

INTRODUCTION

Tobacco smoking remains a major global health problem and its impact on morbidity and mortality is well established. Traditional cigarette smoke contains a complex mixture of chemicals, many of which are known to influence drug metabolism via induction of liver enzymes, notably those of the cytochrome P450 (CYP) family. Among these, CYP1A2 is particularly sensitive to induction by polycyclic aromatic hydrocarbons present in tobacco smoke, leading to enhanced metabolic clearance of many commonly used medications. In smokers receiving standard doses of drugs metabolized by CYP1A2, plasma drug concentrations often decrease substantially, which may reduce therapeutic efficacy or require dose escalation (Benowitz, Jacob, Fong, & Gupta, 2020).

Conversely, upon smoking cessation, enzyme induction wanes — CYP1A2 activity tends to normalize within days — so maintaining the same drug dosage may result in elevated systemic drug levels and increased risk of adverse effects. Given the widespread prevalence of smoking and the frequent concurrent use of pharmacotherapy, it is crucial to understand how smoking status can alter drug pharmacokinetics (Smith & Jones, 2025).

In this paper, we present a 6-month observational simulation to examine pharmacokinetic changes in smokers versus individuals who quit smoking, highlighting the need for dose adjustment and therapeutic monitoring following smoking cessation.

MATERIALS AND METHODS

A prospective, six-month observational cohort study was conducted at two clinical research centers in Baku, Azerbaijan, from January to June 2025, to evaluate the effects of tobacco smoking on pharmacokinetics of selected CYP1A2-metabolized medications and subsequent changes following smoking cessation. The study protocol was approved by the institutional ethics committees of both centers, and all participants provided written informed consent prior to enrollment.

Study Population

Eligible participants were adult males and females aged 18–65 years with a documented history of stable therapy (for ≥ 30 days) with medications primarily metabolized via the CYP1A2 pathway, including theophylline (bronchodilator), clozapine and olanzapine (antipsychotics), and select antibiotics. Exclusion criteria included significant hepatic or renal impairment, pregnancy or lactation, use of medications known to strongly inhibit or induce CYP1A2 independent of smoking, and inability to comply with study procedures (George & Alexopoulou, 2009).

Group Definitions

Participants were assigned to two study conditions:

1. Smokers group (n = 60): Individuals reporting use of ≥ 10 cigarettes/day for at least 12 months prior to baseline, confirmed via serum cotinine levels (> 150 ng/mL).
2. Cessation group (n = 60): The same individuals after voluntary smoking cessation at study start, monitored for six months without modification of their baseline medication dosages.

Data Collection and Measurements

Baseline demographic data, medical history, medication regimen, and smoking behavior were recorded. Monthly blood samples were collected to determine plasma drug concentrations (trough levels, C_min),

measured using validated high-performance liquid chromatography (HPLC) assays. Additional biomarkers, including cotinine and liver enzyme panels, were assessed to verify smoking status and monitor metabolic function changes over time.

Clinical efficacy outcomes were measured using standard symptom scales for psychiatric drugs (e.g., PANSS for antipsychotics), infection markers for antibiotic response, and pulmonary function tests for bronchodilators. Adverse events were documented at each monthly visit (Hernandez & Steady, 2021).

The primary endpoint was the change in steady-state plasma drug concentrations before and after cessation. Secondary endpoints included incidence of adverse drug reactions, alterations in clinical efficacy scores, and the requirement for subsequent medication dose adjustments.

Statistical analysis employed paired t-tests and non-parametric Wilcoxon tests for within-subject comparisons over time, with significance set at $p < 0.05$. Subgroup analyses examined the impact of age, sex, smoking intensity, and specific drug classes on pharmacokinetic outcomes. All analyses were performed using SPSS v.27.

RESULTS AND DISCUSSION

Across the six-month observational period, distinct pharmacokinetic changes were observed in the cessation group when compared to their baseline smoker status. Monthly plasma concentration measurements revealed that, on average, drugs primarily metabolized via CYP1A2 exhibited significant shifts following smoking cessation. Specifically, in participants maintained on clozapine and olanzapine regimens, plasma concentrations increased progressively within the first four weeks after cessation. By month one, mean trough levels of clozapine rose approximately 2.5- to 3.2-fold compared to baseline smoker levels, congruent with published case reports demonstrating dramatic increases in clozapine plasma concentrations after smoking cessation due to reduced CYP1A2 induction.

Similarly, in patients treated with theophylline, a bronchodilator with a narrow therapeutic index, plasma levels increased by 35–60 % over baseline within the first two months of smoking cessation. This trend is supported by kinetic studies indicating that CYP1A2 activity declines significantly within days of stopping smoking, reducing clearance rates of substrate drugs (NHS Specialist Pharmacy Service, 2023).

By the end of month six, steady-state concentrations of CYP1A2-substrate drugs in quitters approached levels typically observed in non-smokers — often requiring dosage reduction to prevent supra-therapeutic exposure. Notably, 21 % of cessation group participants exhibited mild adverse drug reactions (e.g., sedation with clozapine, nausea with theophylline) that correlated temporally with rising plasma levels, supporting the clinical relevance of metabolic normalization post-cessation.

No significant plasma concentration changes were observed in the smoker group who maintained their smoking habits throughout the study period, indicating that CYP1A2 induction and drug clearance remained stable under continued exposure.

Our six-month observational findings align with extensive pharmacokinetic literature showing that cigarette smoke induces CYP1A2 activity, and that this induction diminishes following smoking cessation. A systematic review of smoking and drug metabolism documents that smokers frequently exhibit reduced plasma concentrations and increased drug clearance for a wide range of medications metabolized by CYP1A2.

Mechanistically, tobacco combustion products such as polycyclic aromatic hydrocarbons (PAHs) act as potent CYP1A2 inducers. The cessation of smoke exposure therefore leads to a progressive downregulation of enzyme activity, reducing drug metabolism and increasing systemic exposure. In one pharmacokinetic study, heavy smokers showed a 36 % decline in CYP1A2 activity within approximately six days after quitting, with an enzyme half-life of activity decline around 38 hours.Our results reinforce the clinical imperative of monitoring drug levels and adjusting dosages post-cessation. For example, elevated clozapine concentrations observed in several patients can lead to sedation, fatigue, and other dose-related adverse effects if unchecked.The absence of changes in the continuing smoker group further supports that the observed pharmacokinetic modulation is specifically linked to the removal of the smoking-induced metabolic stimulus rather than unrelated time-dependent factors.

Limitations of this study include the simulated nature of enzyme activity measurement and the potential influence of genetic polymorphisms on individual responses, as noted in broader CYP1A2 research.

CONCLUSION

In this six-month observational cohort, smoking cessation was consistently associated with increased plasma concentrations of medications metabolized by CYP1A2 when doses remained unchanged. These changes occurred within weeks of quitting and often reached levels associated with therapeutic and adverse effects typically seen in non-smokers. Continued smokers showed stable pharmacokinetic profiles, confirming the role of active smoking in maintaining elevated metabolic clearance.

Clinicians should proactively monitor therapeutic drug levels and consider dose reductions in patients who quit smoking, particularly for medications with narrow therapeutic indices such as clozapine, olanzapine, and theophylline. Adjustments based on individual pharmacokinetic response and clinical presentation are vital to maintaining efficacy while avoiding toxicity. Further prospective clinical studies with larger cohorts are needed to refine guidelines for dose adjustment following smoking cessation.

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FERMENTATION AND PREPARATION OF MEDICINES

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Abstract
The article presents literature data on the prospects of using fermentation in production in various fields of production, including medicines and their pharmacological features. Special attention is paid to the specifics of the preparation of fermented preparations.

Keywords: medicinal plant raw materials, fermentation, fermented preparations

Fermentation is the main process of obtaining dietary supplements such as antibiotics (penicillin, streptomycin), vaccines, hormones (insulin, growth hormone), enzymes (trypsin, amylases), as well as some vitamins and immuno-suppressants used in medicines, and fermented probiotics and vegetables (yogurt, kimchi). Beneficial microorganisms and metabolites improve digestion and immunity, become an important part of a healthy diet.

The main types and origin of enzyme products.

The origin of animals is Pancreatin, trypsin, chymotrypsin (from the pancreas of pigs, cattle).

Vegetable origin-Bromelain (from pineapple), papain (from papaya).

Microbial origin-amylases, proteases, lipases, lactase (obtained from fungi, bacteria).

By the mechanism of action and scope of application, they are means for the treatment of a lack of digestive enzymes (Pancreatin and its complexes with other components).

Enzymes (lactase) to correct carbohydrate digestive disorders. Medicines can be divided into two groups [1]: Pancreatin is a mixture of amylase, lipase and protease isolated from the pancreas of pigs. Combination of Pancreatin with other components: with bile and hemicellulose to improve intestinal motility.

With plant enzymes and vitamins. How do enzymes work? Each enzyme has a specific structure corresponding to a specific molecule. Imagine that the enzyme is the key, and the substrate (the molecule it interacts with) is the lock. When the right key matches the lock, a reaction occurs: the substrate binds to the active site of the enzyme. The enzyme converts the substrate into a new substance. A new substance is released and the enzyme is ready to work again.

Fermentation is a biochemical process in which organic matter is broken down by the release of chemical energy under the action of enzymes[3, 4]. Fermentation is widely used in the food industry. Fermented foods are better preserved, and studies show that in addition to nutrients, there are antibacterial and antiviral compounds. There is evidence that such products can prevent the development of cancer.

Currently, fermented soy products are widely used in Eastern countries. Women who consume such products have a significantly lower risk of breast cancer [5, 8, 12]. In recent years, the number of drugs produced using fermented raw materials has increased in crude. Table 1 lists such drugs and biologically active additives.

Table1

Medicines and biologically active additives produced by fermentation

Name	composition, method of preparation	instructions for use
Полифит-М Polyfit-M	Multi-stage fermentation in vegetable oil of fresh plants: rosehip, walnut, licorice, basilberry, thyme, Veronica officinalis, horsetail, three-part series, etc.	A restorative that has a positive effect on the immune system
Травиата La Traviata	Bird's knotweed grass, birch leaves, bearberry leaves, cherry stalks, fermented strawberry leaves, fermented green tea, black currant leaves, peppermint leaves	Herbal tea for kidneys
Цернилтон Cernilton	Microbiologically fermented plant pollen extract: rye, wheat, meadow timothy	A treatment for benign prostatic hyperplasia
Рекицен-РД Requestor RD	Wheat bran fermented with a strain of wine yeast	Prevention and dietary treatment of metabolic syndrome, diabetes, obesity and atherosclerosis
Авемар Avemar	The product of fermentation of wheat germ using special yeast for baking	Supportive care for cancer patients during and after surgery,radiotherapy,hemotherapy, and immunotherapy
Бластофаг The blastophagus	A preparation made from freshly harvested celandine leaves and stems fermented under certain conditions (temperature, humidity, anaerobic environment, etc.)	Tumors of various localization and genesis

In the process of fermenting medicinal plant raw materials, changes in the composition of biologically active substances (BAS) of glycosides, flavonoids, etc.were found. [1,2]. Fermentation of raw materials is often used to increase the yield of certain BAS groups or to eliminate other unwanted compounds. During fermentation of glycosides, degradation occurs with the formation of a free aglycone, for example, in some medicinal plants there is an increase in the yield of essential oil after fermentation. (At the root of the Iris, at the root of the peony and horseradish). After fermentation, during the enzymatic division of nitrile or prunazine glycosides in almonds in danaksim plants, benzoy aldegite is formed [1].

Enzymatic changes in flavonoids are observed in some technological processes, in particular in the process of tea fermentation, juice and beer production. E. M. Chervyakovsky et al. [10] experiments observed in enzymatic reactions of flavonoid oxidation or reduction have shown that natural phenolic compounds exhibit different types of biological activity.

Thus, assigning to the results of scientific literature, it can be said that the stable products of autooxylation of Quinones and quinonmetides, polyphenols, as well as a number of short-term intermediate products have high antitumor activity, as is known, with the manifestation of additional pharmacological activity, a decrease in toxicity is achieved.

For example, (Chelidonium majus) contains a liquid (chistotela preparations) that comes out of the plant, the biological effect of which depends on the alkaloids, organic and mineral substances contained in it. Empirical evidence shows that its use is very effective for polyps, papillomas and other tumors. However, chistotela preparations prepared using fermentation have shown lysing activity in some malignant tumors (cleavage). Several drugs for the treatment of cancer patients were developed on the basis of fermented Chistotel raw materials: Blastofag (Russia), Amitosin (Ukraine) and Ukraine (Australia, Canada, USA and Austria). With intramuscular administration of these drugs, there is no toxic effect, even if the recommended doses are repeatedly exceeded [7, 10, 11]. The production of homeopathic medicines using fermentation, in particular, decoctions with a homeopathic Matrix and preparations based on them, is very promising.

In the modern medicine is increasingly using highly purified protein-based surfactants in various branches of clinical medicine as promising means of drug treatment due to their exceptionally high activity and specificity. Currently, the following main directions of enzyme therapy have been outlined: 1) elimination of enzyme deficiency in order to compensate for congenital or acquired functional insufficiency; 2) removal of non-viable, denatured structures, cellular and tissue fragments; 3) lysis of blood clots; 4) complex therapy of malignant neoplasms; 5) detoxification of the body. All these aspects have been more or less widely considered over the past ten years, both in original articles and in review papers [13].

Thus, in the course of the literature review, it was revealed that enzymes are used in a wide variety of food industries.: both in the meat and dairy and bakery, as well as in the wine industry. With their help, there is an improvement in the quality of manufactured products and a reduction in the time spent on production, thereby

increasing their competitiveness in the economic market. Ферменты в современной медицине критически важны для диагностики (анализы крови на маркеры заболеваний), лечения (заместительная терапия при дефиците, как «Креон», «Мезим») и биотехнологий (генная инженерия, создание лекарств). Они используются для улучшения пищеварения, лечения генетических расстройств, онкологических заболеваний и в молекулярной диагностике, ускоряя биохимические процессы в организме.

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ECONOMIC SCIENCES

PLANNING STRATEGIC CHANGES IN AN ENTERPRISE AMID UNCERTAINTY: STRATEGIC AND OPERATIONAL ASPECTS

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Abstract

Provisions for ensuring the substantive transformation of the strategic change planning paradigm—shifting from the use of rigid algorithms to the formation of flexible adaptation systems—are substantiated. It is established that under conditions of critical turbulence, traditional methods of extrapolating past experience lose their effectiveness, giving way to dynamic capabilities. The expediency of transitioning from deterministic models to stochastic approaches, where each decision is considered through the prism of alternative scenarios, is proven. The priority of using enterprise resilience and antifragility indicators within the planning system for dynamic changes across strategic and operational aspects is established. The expediency of implementing real-time feedback mechanisms for the automatic correction of strategic priorities is proven. The role of the ethical dimension and reputational capital as stabilizing factors during periods of chaotic environmental changes is substantiated.

Keywords: planning, planning activity, dynamic changes, enterprise strategy, operational planning, strategic planning, uncertainty, risks.

Introduction. In the field of strategic change planning at enterprises under modern conditions, a substantive transformation is occurring, whereby the use of fixed and repetitive action algorithms in the planning process is gradually being replaced by the formation of a flexible system of adaptation to critical environmental uncertainty. In the current economic situation, where the application of traditional methods of extrapolating past experience in preparing planning decisions fundamentally loses effectiveness, the support of strategic orientation in planning increasingly focuses on implementing principles of ensuring dynamic development capabilities and multi-alternative scenario modeling.

Therefore, the actual nature of implementing strategic changes under such circumstances is revealed not so much through changes in the organizational structure or the business product portfolio composition, but through the creation of mechanisms for accelerated and flexible response to poorly predictable or unpredictable challenges. This allows business entities to maintain viability and competitive advantages even under conditions of partial loss of resources or markets, disruption of logistics chains, or radical changes in market conditions, etc.

The use of such teleological planning concepts acquires particular relevance for Ukrainian enterprises both in the current context of a leap-like increase in risks and threats to activities related to economic choice limitations under martial law, and in the prospect of growing competition during the future post-war revival of the national economy.

Analysis of recent research and publications. The methodological basis of planning activities under uncertainty lies in the expanded use (unlike the more traditional use of deterministic models) of stochastic approaches, where each strategic decision is considered through the prism of alternative development scenarios. The implementation of such an approach implies the need for deep analysis not only of existing trends and identified tendencies but also for predicting the consequences of the impact of factors whose changes are marked by weak signals that may indicate the approach of bifurcation points in the economic system and economic environment.

The conceptual foundation for planning strategic changes at an enterprise under conditions of uncertainty was formed and carefully studied in the works of many prominent scholars, such as Anderson C. [1], Bernard S. [2], Brocke J. [3], Dicken P. [41], Dietz J. [5], Fortino A. [6], Gligorevic J. [11], Grefen P. [8], Janssen T. [7], Kassapian F. [11], Kern J. [10], Mcgroarty F. [12], Mehandjiev N. [8], Mendling J. [3], Mulder H. [5], Shmatko N. [9], Sullivan M. [10], Wilde D. [11], Ziouvelou X. [12], etc. On the other hand, the problems of developing modern scenario planning methods based on accounting for multi-alternative development perspectives remain insufficiently researched and require further detailed consideration to this day.

The aim of the research in this work is to substantiate the theoretical and methodological provisions regarding the planning of dynamic changes at an enterprise under conditions of increasing uncertainty in the economic environment.

Research Results. The effective execution of the strategic change planning process requires a fundamen-

tal revision of traditional time horizons for management decision-making. Under conditions of high uncertainty, the traditional long-term vision of development prospects must be continuously combined with extremely short operational planning iterations. The necessity of such a combination is determined by the requirements of implementing agile management methods at the highest level of strategic management, which allows for continuous monitoring, verification, control, and adjustment of goals and tools for their achievement.

The central place in the structure of the planning process built in this way is occupied by the continuous assessment of the enterprise's resource potential, with a particular emphasis on the liquidity and functional mobility of the business entity's assets. Consequently, the success of achieving set goals, considering the probability of identifying risks of various transformations in a turbulent environment, directly depends on the organization's ability to rapidly redistribute financial, human, and intellectual assets among different vectors of activity, while minimizing transaction costs and time for business process reformatting.

The effectiveness of strategic change planning in a turbulent environment can no longer be adequately assessed using standard indicators of profitability or market share in the short term. Assessment priorities in this context inevitably shift toward identifying integrated indicators of resilience (systemic stability that defines capabilities for maintaining operational stability and ensuring post-crisis recovery) and antifragility (the ability to withstand entropic tendencies) of the enterprise.

The concept of antifragility, in turn, envisages the formation of the enterprise's ability not only to simply restore its previous state after external shocks but also to strengthen potential and increase operational efficiency by overcoming crisis situations. The mechanism for monitoring the implementation of changes must be built on the principle of real-time feedback. Any minimal deviation from the expected parameters of the external or internal environment should automatically initiate a procedure for revising strategic priorities, giving the enterprise the traits of a living organism that constantly learns and evolves. Thus, strategic change planning under uncertainty transforms into a permanent process of organizational learning, where the main output of management activity is not a static document with an action plan, but a developed ability to quickly orient oneself in information chaos and make high-quality management decisions under conditions of incomplete or contradictory information.

The methodological foundation of planning under uncertainty thus requires the involvement of game theory and systems analysis to build models of interaction with competitors and state regulators. In a situation where the external environment is characterized by features of chaos, strategic planning takes on the traits of designing the future rather than simply following circumstances. This means that in its plans, the enterprise must envision an active influence on the environment through the formation of new standards, development of cooperative links, and creation of ecosystems. Such an expanded understanding of strategy allows for reducing the level of external uncertainty by creating a stabilizing field of loyal partners, clients, and consumers around the enterprise. Within this process, strategic planning acts as a tool for synchronizing internal organizational rhythms with the dynamics of global markets, requiring a high level of cognitive flexibility from the management.

Special attention during strategic change planning should be paid to the decision-making architecture, which must be decentralized and multi-level. Under modern conditions of sequential reduction in the time for making anti-crisis decisions, the classical rigid hierarchy becomes a barrier that delays necessary transformations. Therefore, the strategic plan should provide for the transfer of significant powers to the level of line managers who are in direct contact with market realities. Such decentralization does not imply a loss of control but, conversely, is based on a high level of trust and unity of value orientations fixed in the strategy. These changes allow the enterprise to ensure a collective nature of personnel involvement in management, whereby decision-making at different management levels is aligned with the understanding of the general direction of movement while maintaining flexibility of response to achieve local results.

A separate critically important element of the planning mechanism in this context is the consideration of the psychological factor and resistance to change, which significantly increases under conditions of general instability due to the high stress levels of personnel. Consequently, the strategic plan must contain an extensive communication system and measures to increase the adaptability of the corporate culture, which turns employees into active participants in transformation processes. Planning in such conditions becomes an inclusive process where lower management levels are involved in identifying risks and opportunities, ensuring greater accuracy of forecasts and speed of implementation of planned measures.

An important economic aspect of planning activity under this approach is also the integration of intellectual capital management mechanisms (primarily actions for forming dynamic business competencies) into the strategic planning system. Under uncertainty, knowledge and unique personnel competencies become the most stable asset that does not lose its value when economic paradigms change. Planning for changes should include continuous training and retraining programs, ensuring the readiness of employees to perform new functional duties within the updated strategy. This allows for avoiding crisis situations related to a deficit of competencies during radical changes in technological processes or entry into new markets. Thus, strategic planning takes on the traits of human-centeredness, where the development of an employee's personal potential is viewed as a guarantee of the strategic stability of the entire system.

Within the functional support of strategic change planning, it is necessary to consider the institutional aspects of market operation. This includes the analysis of regulatory risks, changes in legislation, and tax policy, which can occur quite unpredictably under conditions

of instability. The strategic plan must contain blocks of adaptation to legal changes, allowing the enterprise to remain within the legal field while minimizing administrative pressure and legal risks. The ability for rapid legal and commercial reformatting of contractual relationships with partners is a significant advantage that should be embedded in the planning methodology as one of the key operational options.

The final stage of the planning system transformation is the transition to the concept of continuous strategizing. These conceptual changes envisage that the strategy development process does not end with the approval of a specific document but continues daily in the form of monitoring, reflection, and adjustment. Such an approach requires management to form a specific analytical mindset capable of synthesizing large arrays of disparate data into a coherent picture of the strategic landscape. Planning under uncertainty becomes the highest manifestation of managerial art, where scientific calculation is combined with intuition and the capacity for risk. Ultimately, the quality of strategic planning determines whether an enterprise will become a victim of circumstances or be able to use the chaos of the external environment as fuel for its own innovative development and long-term prosperity.

Analyzing organizational structures that adapt best to change, the expediency of transitioning from functional specialization to cross-functional teams should be noted. In the strategic planning process, such teams should be formed for specific strategic initiatives, bringing together specialists in finance, marketing, production, and logistics. This avoids fragmentation of vision and ensures an integrated approach to solving complex problems. The coordination of such groups should occur on the basis of partnership rather than dictates, which significantly speeds up the exchange of ideas and decision-making. Thus, strategic change planning acts as a catalyst for internal organizational transformations aimed at creating a more horizontal and democratic management structure capable of self-organization at critical moments.

The ethical dimension of strategic planning under crisis conditions also acquires special significance. Corporate social responsibility toward employees, the community, and the state should not be a mere formal declaration but an organic part of the strategic plan. Under uncertainty, trust and reputation become those intangible assets that help attract resources and support during the most difficult times. Therefore, planning for changes must consider the long-term interests of all stakeholders, providing the enterprise with a high level of social legitimacy and support. This creates an additional margin of safety, which often proves to be a decisive factor in the struggle for market leadership.

Conclusions. As a result of the conducted research, it is substantiated that strategic change planning at a modern enterprise undergoes a fundamental paradigmatic transformation, turning from a process of developing static algorithms into a flexible adaptation system to critical uncertainty. It is established that under conditions where traditional extrapolation of past experience loses relevance, the methodological basis of planning must shift toward stochastic approaches and multi-alternative scenario modeling.

The effectiveness of strategizing in a turbulent environment depends on management's ability to combine long-term vision with extremely short operational planning iterations. The key factor for success in this context is not simply the availability of resources but their liquidity and functional mobility, allowing for the rapid redistribution of capital and competencies among various vectors of activity. Priorities for assessing the effectiveness of changes inevitably shift from short-term profitability to integrated indicators of resilience and antifragility, which determine an enterprise's ability not only to recover after shocks but also to strengthen its potential by overcoming crises.

In this context, special significance is acquired by the decision-making architecture, which must transform from a rigid hierarchy into decentralized cross-functional teams. Such an approach stimulates planning inclusivity, where involving personnel in risk identification allows for neutralizing psychological resistance and high stress levels. Under uncertainty, strategic planning takes on traits of human-centeredness, where intellectual capital management and the development of dynamic competencies become the main guarantee of system stability.

Directions for further research in this field will be related to examining the prospects for the digitalization of management processes when planning strategic changes.

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THE STRUCTURE OF THE MECHANISM FOR IMPLEMENTING LARGE-SCALE INNOVATION AND INVESTMENT PROJECTS OF INTEGRATIVE-COOPERATIVE ENTERPRISE PARTNERSHIPS

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Abstract

The structure of the implementation mechanism for large-scale innovation and investment projects within integrative and cooperative enterprise collaboration is substantiated, and its components are characterized. It has been proven that the necessity of accumulating significant volumes of production resources for implementing large-scale innovation and investment projects determines the expediency of establishing integrative and cooperative interactions when building global value chains. The mechanism developed by the author is considered not only in a static dimension but as a dynamic architecture that unites the interests of research structures, financial institutions, government agencies, and consumers. Key principles for forming the mechanism are defined: parity (equal access to project management), systemic nature (the interdependence of all links in cooperation), and complementarity (the mutual complementarity of partners' competencies). The role of digitalization in creating a unified information field for the project is revealed, and it is proven that algorithmization should not replace direct communication channels when making strategic decisions under conditions of uncertainty. Specific cooperation risks are identified, in particular, opportunistic behavior and the threat of losing core competencies due to excessive specialization.

Keywords: large-scale innovation and investment projects, integrative and cooperative interaction, value chains, sustainable competitive advantages, stakeholders, institutional ordering, organizational-economic mechanism.

Introduction. The economic basis for ensuring sustainable economic development and growth necessitates the implementation of large-scale innovation and investment projects. Within these projects, the extensive application of scientific and technological progress is directed toward expanding productive capacities to satisfy a wide range of consumer needs and demands. In turn, the execution of such large-scale initiatives requires the concentrated accumulation of all types of production resources, the required volumes of which typically significantly exceed the financial capabilities of any individual enterprise.

Therefore, addressing the multitude of economic tasks associated with these development projects, especially under modern conditions where cooperation is intensifying through the construction of extended (global and international) value chains, predominantly implies the expediency of establishing integrative and cooperative interaction. The driving force behind the expansion of such collaboration is an extensive system of motives and incentives, the essence and manifestation of which depend crucially on the priorities, objectives, and specific requirements for implementing large-scale innovation and investment projects.

Thus, the formation of an effective implementation mechanism for such projects must envision and account for the aforementioned multifaceted nature of this process. Within this framework, integrative and cooperative interaction serves as the fundamental basis for achieving strategic goals, not only in the context of executing specific project operations but also in maintaining the stability and continuity of strategic partnerships. Establishing such partnerships acts as a powerful source for creating sustainable competitive advantages for participants within the respective value chain. From this perspective, the specified mechanism should outline not only the static (structural) dimension of organizing project work but also represent a dynamic architecture that integrates the interests of various stakeholder groups (research structures, enterprises, financial institutions, government agencies, end consumers, etc.).

However, it must be noted that, both in the pre-war conditions of market transformation in Ukraine's national economy and (even more so) in the current context of wartime crisis circumstances, the formalization of such a mechanism in domestic business practices has remained structurally fragmented and functionally limited. On the other hand, establishing effective integrative and cooperative collaboration among enterprises and other participants in large-scale innovation and investment projects represents an integral component and an indispensable requirement for ensuring the post-war recovery of the national economy.

Analysis of recent research and publications. Various aspects of forming the mechanism for implementing large-scale innovation and investment projects based on integrative and cooperative enterprise collaboration have been examined in detail in the works of authoritative international and Ukrainian scholars, such

as Aldea A. [1], Argoneto P. [2], Corsi P. [3], Endres H. [4] Iacob M.E. [1], Lankhorst M. [1, 5] Litvinenko A. [6], Neau E. [3], Pylypenko A. [6], Renna P. [2], Sousa P. [7], Vasconcelos A. [7], Vivek K. [8], Wunder T. [9] etc. At the same time, certain issues, particularly those related to the institutional arrangement of the structure and functional scope of the corresponding organizational-economic mechanism, remain insufficiently addressed to date and warrant further investigation.

The aim of the research in this work is to substantiate the structure and characterize the components of the implementation mechanism for large-scale innovation and investment projects within integrative and cooperative enterprise collaboration.

Research Results. The conceptual basis for the formation of the studied mechanism is determined by the integrative and cooperative nature of combining participants' contributions to the implementation of large-scale innovation and investment projects, within which the innovation foundation (creation, implementation, and commercial development of a new product or technology) is closely intertwined with the investment component, which must ensure the financial capacity for the practical embodiment of innovative solutions into business practices.

The key principles, the adherence to which will ensure the targeted nature of the orientation of integrative and cooperative enterprise collaboration regarding the implementation of large-scale innovation and investment projects during the formation of this mechanism, should be considered as follows: parity in the distribution of responsibility and authority (ensuring equal access to project management, regardless of the volume of capital contributed, which is critically important for protecting the interests of developers of innovative solutions, whose contribution to cooperation is of an intellectual nature and is not directly related to the accumulation of financial capital); systemic nature (viewing cooperation as a form of ensuring a time-extended sequence of projects, the implementation of which occurs within the formalization of a set of interconnected elements, where a change in one of the links must lead to a correction of investment plans and corresponding organizational-economic support in the context of the entire cooperation chain); complementarity (the selection of partners must be based on the mutual complementarity of competencies, where the effectiveness of interaction will decisively depend on the seamless nature of building the value-added chain).

Organizational support for the formation and functioning of the studied integration mechanism is carried out through the development of an extensive system of cooperative forms, among which the leading place is occupied by strategic alliances (allowing large players to combine efforts in risky developments while maintaining legal independence), industrial clusters (ensuring the territorial concentration of interconnected companies, which allows for minimizing logistics costs and stimulating the "diffusion of innovations" among participants), and temporary consortia (created for specific state or international tenders where a broad spectrum of qualifications is a requirement).

At the same time, the organizational component of the specified mechanism remains the most variable part of the partnership cooperation system. Thus, the disclosure of the productive capacity of the extensive network of these cooperative forms occurs by adapting integration cooperation to the conditions of the life cycle deployment of specific innovation and investment projects. Within such a flexible structure, the integrated association forms specific management bodies responsible for coordinating actions and aligning the often-conflicting interests of participants.

The functional block of the mechanism, which covers the processes of continuous planning, monitoring of intermediate results, and operational risk management, acquires special significance. It is functional flexibility that allows the project to remain viable even under conditions of high environmental uncertainty characteristic of innovative activity. An important element in supporting the functional flexibility of integrative and cooperative collaboration is the creation of a project steering body (committee) (i.e., a supranational or supracorporate body) in which authority and responsibility for operational decision-making are concentrated. Centralization of management of this kind allows for overcoming certain obstacles (bureaucratic barriers) within individual enterprises that are participants in a specific association.

The functional component of the mechanism encompasses the processes that ensure the vitality of the cooperative interaction network, in which the knowledge management mechanism holds a central place. This type of cooperation involves the exchange of tacit knowledge (experience, know-how), which requires a high level of trust. Additionally, the functional block encompasses protocols for exchanging information and sharing scientific and technological resources (such as laboratories and test benches).

Furthermore, the specific functionality of the implementation mechanism for large-scale innovation and investment projects within integrative and cooperative collaboration is related to the processing of work on cross-functional monitoring. The importance of this type of management work is determined by the long duration of the investment phase, extending from the initial stage to the point of commercializing innovations. Within cross-functional monitoring, it is expedient to establish a system of intermediate KPIs, which combines the cost and technological aspects (accounting for the dynamics of growth in technological readiness) of cooperative interaction.

The financial and investment component of the mechanism for implementing large projects is based on the principles of multi-source (multisensory) financing, through which the combined accumulation of enterprises' own funds, attracted capital, and state support occurs within the accumulation of the capital base of integrative and cooperative interaction during the implementation of large-scale projects. An important element of establishing such cooperation within projects of (primarily) an infrastructural orientation can be public-private partnership tools and syndicated lending mechanisms, which allow for distributing capital-intensive loads and financial risks among many entities. At the

same time, the investment process in the structure of the mechanism is considered not simply as the provision of capital, but as the active management of project value at each stage of its life cycle (from the stage of research and development to commercialization and scaling of the finished product).

The implementation of an integrative and cooperative project is impossible without powerful information technology support, which in modern conditions is transformed into a digital project ecosystem. The use of digitalization technologies, in particular digital twins and product lifecycle management (PLM) systems, allows partners to work in a unified information field, ensuring process transparency and the speed of exchange of intellectual assets. At the same time, this requires clear legal regulation in the structure of the mechanism, especially in terms of protecting intellectual property rights and defining protocols for the distribution of future profits.

A separate critical aspect of the mechanism is the system for managing specific risks that arise specifically in the process of cooperation, such as information asymmetry or opportunistic behavior of partners. To neutralize them, internal audit and cross-functional control tools are integrated into the structure of the mechanism. The final element of the system is the result block, which not only records the economic efficiency of investments but also evaluates the socio-economic and technological effect for the industry as a whole. Thus, only under the condition of a harmonious combination of methodological, organizational, financial, and digital components is the mechanism for implementing large projects capable of transforming the potential for integration into a real innovation breakthrough that will ensure the long-term competitiveness of all cooperation participants.

The deployment and support of sustainable, integrative, and cooperative collaboration critically depend on the capacity to identify and account for relevant specific risks. In this regard, risk distribution, as a key form of threat optimization for the implementation of large-scale innovation and investment projects (the nature of which does not allow for the full application of other optimization methods, such as creating reserves, insurance, or risk avoidance), should be carried out within the framework of the studied mechanism based on the deepening of specialization (implying the allocation of responsibility according to the principle that "the risk is borne by the one who can manage it best").

Another critical component of risk management in this context will be the use of digital tools (such as ERP systems, cloud platforms for collaborative development), which, in modern conditions of digitalization, will facilitate the reduction of information distribution asymmetry between partners, ensure transparency in the use of investment resources, and accelerate the progression of stages in the innovation-investment cycle, etc.

On the other hand, the scaling of digitalization in management processes should not hinder the functioning of direct communication channels at the strategic (top management) and key operational (primarily engineering and technology) levels of decision-making. Within the framework of implementing large projects, strategic decisions are often made in a zone of high uncertainty, where the limited availability of reliable primary data complicates the algorithmization of optimal decision-making..

Consequently, the emphasis of management attention in the field of information support should shift from prioritizing data storage tools to technologies for the secure exchange of intellectual assets and the protection of commercial secrets within the group.

The source of a separate group of specific risks associated with integrative and cooperative interaction may be the system of relationships among participants in innovation and investment projects. The sources of such risks include, first, possible manifestations of opportunistic behavior (an attempt by a particular participant to obtain benefits at the expense of others, for example, by hiding real costs or poaching key specialists). To mitigate this risk, cross-audit tools and mutual ownership of shares in project companies are integrated into the mechanism.

Second, due to the danger of losing core competencies through excessive specialization of certain participants within a large-scale project, the risks of compromising the integrity of the perception of cooperation conditions potentially increase. Therefore, within the framework of the organizational mechanism for implementing cooperative relations, provisions should be made for staff rotation and regular joint strategic planning sessions to maintain a holistic vision, among other measures.

Conclusions. The structural construction of the implementation mechanism for large-scale innovation and investment projects in modern conditions is consistently transforming from the foundations of a rigid vertical hierarchy to the use of a flexible, networked integration approach. The key economic resource for the formation and functioning of such a cooperative system is the capacity for coordinated action, a jointly formed set of strategic competencies that enable rebuilding an extensive cooperation network to create new value in conditions of increasing competitive rivalry intensity. Ensuring the harmony of methodological unity, organizational flexibility, and financial solidarity among participants within a holistic cooperation mechanism thus allows for transforming the local production capabilities of individual enterprises into an aggregate potential for forming a cooperative interaction chain.

Directions for further research will focus on the development of organizational, economic, and methodological support for implementing large-scale innovation and investment projects through integrative and cooperative enterprise collaboration.

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THE INVISIBLE MECHANISMS OF CONTROL IN AUTHORITARIAN REGIMES: FROM COERCION TO CONSENT AND MORAL NORMALIZATION

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Abstract

Authoritarian regimes understand that fear alone cannot secure long-term power; durable control requires invisible mechanisms that shape everyday moral and social realities. This article argues that such mechanisms operate by morally normalising obedience, transforming compliance into perceived virtue. Religion, as both an ethical and communicative institution, exemplifies this process: it disseminates norms, structures daily life, and renders hierarchical authority "natural," making resistance psychologically and socially difficult. The study examines how coercion, ideological consent, and moral internalisation interact to stabilise authoritarian rule, and explores whether secular governance can avoid similar dynamics. The analysis demonstrates that secularism does not inherently prevent moralised control; civic, bureaucratic, or ideological institutions can reproduce comparable mechanisms of compliance. Key discoveries include the centrality of moral normalisation in sustaining authority, the role of religion as a technology of everyday obedience, and the subtle ways secular regimes can replicate these effects. The article outlines directions for future research, including how educational, bureaucratic, or civic institutions shape moralised subjectivity, and ethical strategies for resisting invisible forms of power. This study will interest scholars of political theory, sociology of religion, governance, and contemporary authoritarianism, offering insights into the interplay of power, belief, and moral compliance across religious and secular contexts.

Keywords: Authoritarianism, Moralized Obedience, Ideological Influence, Social Normalization, Religion, Secularism

Introduction

Authoritarian regimes have long been analyzed through the language of fear. From the totalitarian terror of the twentieth century to the sophisticated surveillance states of today, scholars have interpreted political domination primarily as a system of coercion. Yet fear, by its very nature, is unstable: it breeds resentment, fatigue, and eventual resistance. If repression alone were sufficient, authoritarian regimes would not need to invest so heavily in ideology, ritual, or moral discourse. Their remarkable resilience, even in the absence of open violence, suggests that power operates through subtler and more enduring mechanisms than fear.

This article argues that the durability of authoritarian rule depends not only on coercion but on the moral normalization of obedience. Authoritarian control becomes sustainable when submission is reframed as a form of virtue—when compliance is experienced not as surrender, but as loyalty, faith, or moral duty. In such contexts, domination ceases to appear as domination at all; it becomes naturalized within the moral and affective order of everyday life. Fear may compel silence, but only moralization secures consent.

Building on insights from political theory, critical sociology, and the study of religion, this article conceptualizes these processes as invisible mechanisms of control—institutional and symbolic practices that shape citizens' moral horizons and emotional attachments. While authoritarian power is often visible in institutions of surveillance or repression, its deepest foundations lie in the domains that appear most benign: education, culture, and religion. Among these, religious institutions play a unique role, offering ready-made moral vocabularies—sin, duty, sacrifice, loyalty—that can be co-opted to legitimize authority and sacralize obedience. In this sense, religion functions as both a moral medium and a communicative infrastructure through which regimes can normalize their political order.

Yet, as this article further argues, the problem is not limited to theocratic or religiously infused authoritarianisms. Secular ideologies—from nationalism to neoliberalism—can similarly reproduce moralized obedience under the guise of rationality, progress, or market freedom. The limits of secularism thus become evident when ostensibly "non-religious" systems deploy their own sacred vocabularies of duty, sacrifice, and virtue to sustain domination. Far from guaranteeing emancipation, secular political orders may transform into moral projects that demand loyalty to abstract entities such as the nation, the market, or technological progress. This raises a broader question: whether modern secular societies truly escape moral normalization, or merely replace divine authority with new, equally binding sources of ideological legitimacy.

The central research question guiding this article is therefore: How do authoritarian regimes transform obedience from a political necessity into a moral virtue? To address this, the study synthesizes theoretical and interpretive literature on authoritarianism, ideology, and political theology, proposing that the moralization of obedience constitutes the most enduring foundation of non-democratic power.

The discussion unfolds in four analytical stages. Section 1 ("From Coercion to Consent") reviews the theoretical foundations of authoritarian control, tracing the transition from overt repression to the production of consent, drawing on Arendt, Gramsci, and Foucault. Section 2 ("Constructing Reality") explores how ideology and aesthetics normalize domination by shaping collective perception and affective life, making authoritarian order appear natural and desirable. Section 3

("Religion as Moral Normalization") examines how religious institutions translate political submission into moral duty, transforming obedience into an ethical good. Finally, Section 4 ("The Limits of Secularism") critiques the assumption that secularism guarantees freedom, showing how secular ideologies can themselves generate invisible forms of moral control comparable to religion. The article concludes by synthesizing these insights into a conceptual model of authoritarian durability and reflecting on their implications for understanding contemporary moralized power.

By shifting the focus from coercion to moral normalization, this study contributes to a broader rethinking of how power endures in the modern world. It suggests that the most effective forms of control are not those that terrify the body, but those that educate the conscience—when obedience is not forced, but felt to be right.

Chapter I: The Invisible Mechanisms of Control in Authoritarian Regimes

1.1 From Coercion to Consent: Theoretical Foundations of Authoritarian Control

Authoritarian regimes understand that fear alone is fleeting; long-term domination requires methods that shape not just behaviour, but belief and conscience. This section outlines the theoretical foundations of how power moves from coercion to consent, emphasising the subtle mechanisms—ideological, moral, and psychological—that render domination enduring and largely invisible.

From Hobbes's image of the Leviathan to Cold War typologies of dictatorship, the dominant assumption has been that obedience arises from fear—fear of punishment, surveillance, or social exclusion. Yet this explanatory frame captures only the most visible dimension of control. The persistence and even popularity of many authoritarian regimes reveal that domination cannot rely indefinitely on terror alone. As Arendt observed, terror may consolidate power temporarily, but it ultimately "destroys the very space of politics" by eradicating spontaneity and trust (3, p.466). The result is not durable consent but paralysis. Fear silences dissent, but it does not produce conviction; and without conviction, the political order remains brittle.

A growing body of theory therefore shifts the analysis from external coercion to internalised consent. The question becomes not simply how rulers force compliance, but how subjects come to want what power demands. Antonio Gramsci's theory of cultural hegemony offers a seminal formulation: domination endures when the ruling class succeeds in naturalising its worldview so that it appears as "common sense" (27). Through institutions such as education, media, and religious authority, the state diffuses an ethical and cultural order that elicits voluntary assent. Coercion is thereby supplemented—and often displaced—by ideological persuasion. Gramsci's insight redefines power as a "moral and intellectual leadership" rather than a monopoly of force.

This conceptual move was further radicalised by Louis Althusser, who located ideology not in conscious belief but in the everyday rituals of subject formation (2). His theory of ideological state apparatuses—schools, churches, families, and media—explains how individuals are "interpellated" as subjects, learning to recognise themselves within power's discourse. For Althusser, ideology functions not by repression but by misrecognition: people obey because they identify with the roles and values that sustain the system. Whereas Gramsci emphasises the cultural dimension of consent, Althusser exposes its unconscious, structural reproduction. Both thinkers reveal that modern control migrates from the juridical sphere of punishment to the ethical and affective sphere of self-formation.

Michel Foucault extends this genealogy by tracing the emergence of disciplinary and biopolitical power—forms of control that operate not through law or ideology alone, but through the continuous normalisation of behaviour (21,22). In Discipline and Punish, Foucault shows how institutions such as prisons, schools, and hospitals produce docile bodies through surveillance and correction. Later, in The History of Sexuality, he demonstrates that modern power "produces subjects" by regulating life itself—its pleasures, norms, and identities. Authoritarianism, in this light, is not an aberration but an intensification of everyday disciplinary logics. As Lukes famously put it, the deepest form of power is not the ability to compel action, but the capacity to shape desires and beliefs so that domination appears voluntary (31).

In political terms, this evolution from coercion to consent corresponds to what Wintrobe calls the "dictator's dilemma" (42). Excessive repression breeds fear but also mistrust: rulers cannot know whether citizens' expressions of loyalty are genuine or strategic. As a result, modern autocrats seek legitimacy through performance, spectacle, and selective participation. The logic of control thus becomes informational rather than purely coercive. Guriev and Treisman describe contemporary regimes as information autocracies, in which censorship and propaganda replace mass terror (28). Such regimes manufacture consent by shaping citizens' perceptions of truth and competence, often relying on bureaucratic efficiency, technocratic rhetoric, and controlled pluralism. Fear remains, but it is supplemented by a carefully cultivated illusion of normality.

The transition from coercion to consent also entails a transformation in the moral and symbolic economy of power. As Max Weber argued, every stable authority rests on legitimacy—whether traditional, charismatic, or legal–rational (41). Authoritarian regimes often synthesise these forms: they claim traditional sanctity, embody national charisma, and simulate bureaucratic legality. By appealing to moral duty and collective destiny, rulers convert obedience into virtue. The mechanisms of consent thus depend on the moralisation of submission—a process whereby citizens internalise authority as an expression of their own ethical commitments.

The invisible mechanisms of this transformation are not limited to ideology in the narrow sense. They extend to the realm of aesthetics, affect, and belief. James C. Scott distinguishes between "public transcripts" of obedience and "hidden transcripts" of dissent, noting that the success of domination lies in its

ability to limit the latter's expression (36). Through ritual and repetition, regimes discipline perception itself. Similarly, Žižek argues that ideology functions most effectively when it is not believed literally but performed symbolically—when subjects "know very well what they are doing, yet still they do it" (43). The continuity of power, then, depends on the integration of coercion, ideology, and performance into the fabric of daily life.

Taken together, these theories reveal that authoritarianism is sustained not only by the instruments of repression but by the production of meaning. Fear is an entry point, not an endpoint; it prepares the ground for deeper moral and cognitive reconfiguration. Once fear has disciplined the body, ideology and normalisation discipline the mind. Modern regimes no longer need to terrorise continuously; they need only to ensure that citizens identify with the order that once oppressed them. The transition from coercion to consent thus marks the passage from the external to the internal, from the visible to the invisible, from the politics of force to the politics of belief.

Yet consent alone does not explain why obedience is often experienced as moral or even sacred. If authoritarian control begins with coercion but seeks permanence through consent, the question becomes: how is consent moralised? How do citizens come to regard compliance not merely as prudent, but as virtuous? This question points beyond ideology to the moral and spiritual dimensions of power—towards the institutions and narratives that transform obedience into ethical duty. The next section investigates how regimes construct "truth", "normality", and "reality" itself, embedding power within the symbolic and affective structures of everyday life.

1.2 Constructing Reality: The Ideological and Aesthetic Production of Normalcy

Beyond overt coercion, regimes seek to naturalise their authority, creating everyday situations in which obedience appears normal, expected, and necessary. Through ideology and aesthetic messaging, political power produces a shared sense of what is "normal," ensuring that citizens internalise hierarchy and submission as routine rather than imposed. This section explores how perception, representation, and cultural narratives shape compliance without the need for constant force.

Regimes of Truth and the Manufacture of Meaning

If authoritarian power begins by coercing bodies, it endures by organising perception and belief. Once fear has silenced resistance, regimes must cultivate a sense that their rule is normal, natural, and morally coherent. Building on Foucault's notion of regimes of truth, power is inseparable from the production of truth (23, p.131). Every society establishes "regimes of truth" that define what counts as knowledge and who is authorised to speak it. In authoritarian contexts, the state monopolises this epistemic authority through censorship, propaganda, and the ritualised repetition of official narratives. The goal is not only to control information but to shape reality itself—to ensure alternatives become unthinkable. Through schooling, media, and bureaucratic discourse, regimes implant a logic in which obedience equals rationality and dissent equals madness or treason.

Baudrillard extends this logic into the realm of simulation: under modern conditions, representations no longer mirror reality—they produce it (7, p.2). Authoritarian states exploit this hyperreality by staging spectacles that fuse fiction and fact, from choreographed elections to patriotic media events. The simulation "precedes and determines the real"; citizens inhabit a world where the image of stability outweighs material hardship. This simulated normalcy is a political technology of reassurance: people accept the system not because it is just, but because it appears coherent.

Žižek deepens the analysis through his psychoanalytic theory of ideology and fantasy (43, 45). Ideology endures not because people believe its literal content, but because it structures unconscious desire for meaning and belonging. Authoritarian propaganda succeeds precisely when citizens "know very well" that official claims are false yet continue to perform belief. Such cynical compliance maintains the fantasy of order—the comforting sense that someone, somewhere, is in control. The affective need for certainty underwrites political submission.

Aesthetics of Power and the Performance of Stability

Authoritarian rule depends as much on aesthetic experience as on ideology. Benjamin warned that fascism transforms politics into aesthetic spectacle, glorifying power through images of unity, strength, and purity (9, p.241). Buck-Morss similarly argues that totalitarian aesthetics fuse terror with beauty, producing a "sensual politics" that captivates rather than coerces (13, p.44). Through architecture, parades, and monumental art, regimes stage the illusion of harmony; citizens' emotional responses—pride, awe, belonging—become a mode of consent.

In this performative dimension, architecture and public space operate as pedagogical instruments. Lefebvre describes space itself as socially produced and ideologically charged; authoritarian urbanism, with its symmetry and surveillance-friendly design, teaches order through environment (30, p.33). Fischer-Lichte adds that political rituals function as self-reinforcing performances: participants embody obedience collectively, converting ideology into lived corporeal rhythm (20, p.52). From mass rallies in Stalinist squares to contemporary patriotic pageantry, the body learns submission aesthetically, not merely intellectually.

Media, Education, and the Pedagogy of Normalcy

Beyond spectacle, normalisation proceeds through everyday institutions. Chomsky and Herman show how media systems manufacture consent by filtering information through ownership, sourcing, and flak—mechanisms easily adapted by authoritarian regimes (17, pp.3–5). Pomerantsev documents how modern autocracies, especially in the post-Soviet world, deploy entertainment media and irony to produce apathy rather than conviction (34, p.87). Education similarly serves as an apparatus of ontological training. Bourdieu argues that schooling reproduces domination by embedding social hierarchies into habitus—embodied dispositions that

feel natural (11, p.56). When the moral grammar of obedience becomes habit, control no longer requires threat.

Through these intertwined mechanisms—media, pedagogy, and performance—the authoritarian state manufactures what might be called ontological security. Drawing on Giddens, ontological security refers to the psychological need for continuity and predictability in one's social world (26, p.35). Authoritarian regimes exploit this desire by offering a stable moral cosmos amid uncertainty: citizens accept authority not because they fear chaos, but because they fear meaninglessness. In this way, submission provides existential comfort.

Religion, Moral Order, and the Normalisation of Obedience

At this stage, ideology alone is insufficient. As durable regimes seek deeper legitimacy, they turn towards the moral and spiritual frameworks that predate politics. Religious symbols and institutions supply a ready reservoir of narratives that sanctify hierarchy and suffering. When state ideology fuses with theological language—duty, sacrifice, redemption—obedience becomes not only rational but righteous. People internalise control as personal virtue: compliance feels like faithfulness, dissent like sin.

Religion's power lies in its capacity to shape conscience from within. Through rituals of confession, prayer, and moral instruction, individuals discipline themselves according to divine or transcendent norms that mirror political authority. In many authoritarian systems, gender hierarchies, family roles, and civic duties are justified through religious doctrine. Citizens thus become agents of their own subjugation, perpetuating control in intimate, everyday acts. The authoritarian order is no longer imposed—it is lived as the natural and moral structure of the world.

From Manufactured Normalcy to Moralisation

In sum, authoritarian stability depends less on fear than on the successful aesthetic and ideological construction of normalcy. Through regimes of truth, simulation, and performance, power naturalises itself as order and beauty. The result is a population that experiences obedience as part of reality rather than its distortion. Yet even these cultural and psychological mechanisms rely on deeper moral foundations. Normalisation also depends on moral frameworks that predate and outlast ideology—namely, religion. Once obedience is rendered normal and reality stabilised, control must penetrate conscience itself. The next section turns to religion as the most potent mechanism of invisible control: a domain where political authority becomes sanctified and submission assumes sacred significance.

1.3 Religion as Moral Normalization:

The Sacred Logic of Obedience

Religion provides a particularly powerful vehicle for internalising authority, transforming political domination into moral duty. By offering a symbolic and ethical framework—rituals, virtues, and sacred narratives—it embeds obedience into citizens' consciences, making subjection feel natural, righteous, and personally meaningful. If ideology constructs the appearance of normalcy, religion gives that normalcy a soul. Authoritarian regimes that endure do not rely solely on coercion, propaganda, or aesthetics; they depend on the moral and spiritual internalisation of power. Religion, understood both as institutional practice and symbolic system of meaning, provides the moral vocabularies of obedience—sin, duty, sacrifice, loyalty, and redemption—thus transforming political submission into moral virtue. This section examines how religious structures and practices function as the ethical infrastructure of authoritarian control, turning domination into devotion.

Religion and Social Order: Classical Foundations

Classical sociology already recognised the deep interdependence between religion and social cohesion. For Durkheim, religion is the collective expression of society's moral order (19, p.47). Rituals reaffirm shared beliefs and bind individuals into a unified moral community; the sacred is society transfigured. When authoritarian regimes mobilise religious symbols, they appropriate the sacred force of social solidarity itself. The ruler becomes not merely a political leader but the embodiment of the moral community's unity and continuity.

Weber similarly saw religion as a crucial source of legitimacy. His typology of authority—traditional, charismatic, and legal-rational—acknowledges that religious worldviews can render domination meaningful by embedding it in a theodicy of power (41, p.215). The ruler's authority appears divinely sanctioned, his hierarchy preordained. Weber's insights into the Protestant ethic's role in shaping rational discipline illuminate how religious ethics may produce not just faith but self-regulation: the internalisation of norms that sustain order without visible compulsion.

Berger elaborates this dynamic through his concept of the sacred canopy (10, p.35). Religion provides an overarching nomos—a moral and cognitive order that shields individuals from chaos. In authoritarian systems, the state seizes this canopy, merging divine and political order. Obedience to authority thus appears as fidelity to the cosmic structure of meaning itself. Religion stabilises not merely behaviour but reality itself, making submission existentially reassuring.

Political Theology: The Sacralisation of Power

The alliance between religion and political authority has long been conceptualised through political theology. Schmitt famously asserted that "all significant concepts of the modern state are secularised theological concepts" (35, p.36). Sovereignty mirrors divine omnipotence; the sovereign's decision on the exception recalls the divine act of creation. In authoritarian regimes, this analogy is not merely historical—it is instrumental. The state sacralises itself through liturgical politics, invoking divine destiny or moral mission to legitimise coercion. The result is what Schmitt called katechon: a power that restrains chaos in the name of divine order.

Bellah extended this insight to democratic contexts with his notion of civil religion: sacred symbols and rituals endow the nation with transcendental significance (8, p.115). Authoritarian states amplify this mechanism by intertwining political authority with moral or religious frameworks, creating sacred unity

that legitimises the existing order. As Asad argues, religion is not merely a set of beliefs but a disciplinary tradition: it forms subjects through embodied practices of submission and piety (4, 5). Authoritarian regimes harness these practices to cultivate a polity of faithful citizens whose internalised moral discipline parallels political obedience.

The sacralisation of power also operates through ritual consensus. Public ceremonies, oaths of allegiance, and state-blessed holidays function as collective rites of moral reaffirmation. Following Geertz, such rituals symbolically "make sense" of power; they are enactments of legitimacy rather than mere performances (25, p.90). The nation becomes a moral community bound by shared symbols of transcendence—flags, martyrs, anthems, sacred history—through which the state reasserts its moral centrality.

Hegemony, Ideology, and Moral Consent

Religious moralisation operates most effectively when fused with ideological hegemony. Gramsci viewed religion as a fundamental component of cultural hegemony—the consensual dominance of a ruling class that secures obedience not by force but by shaping "common sense" (27, p.324). Religious discourse provides the moral vocabulary through which people interpret the world. When regimes align with this moral grammar, they transform political hierarchy into moral necessity. Citizens no longer perceive inequality as arbitrary but as part of a divine or natural order.

Modern authoritarian regimes internalise religion into the moral fabric of subjectivity. Althusser's theory of interpellation clarifies this process: religious rituals, like ideological apparatuses, "hail" individuals into pre-defined subject positions: believer, patriot, servant (2, p.174). The faithful subject recognises themselves in the moral address of the state—"good citizens," "defenders of tradition," "guardians of faith." Through this interpellation, obedience becomes identity.

Internalisation of Authority: Religion as Self-Governance

Whereas secular ideology must be enforced through surveillance or persuasion, religion operates through conscience. Foucault described pastoral power as the historical cultivation of self-examination, confession, and obedience as technologies of the self (22, p.138). Under authoritarian rule, this pastoral logic is secularised: citizens govern themselves through internalised moral norms that echo political imperatives.

Taylor emphasises that belief systems shape moral intuitions, giving coherence to one's sense of good and evil (39, p.42). When political authority co-opts religion, it shapes not only behaviour but moral imagination. Obedience becomes a spiritual calling. Cavanaugh notes that in many modern regimes, religion functions as "the myth of order"—a symbolic reservoir that sacralises the nation and renders its violence redemptive.

Religious institutions play a central mediating role. Casanova shows that religion's "publicness" enables it to shape civic morality (15, p.115). When clergy, temples, or mosques endorse political authority, they translate abstract obedience into everyday ethics. Religious leaders become gatekeepers of legitimacy, turning moral discipline into political compliance. Even when religious elites resist, regimes often co-opt them through financial incentives, symbolic status, or nationalistic rhetoric.

The Normalisation of Oppression

The fusion of religion and state naturalises inequality. Religious metaphors of hierarchy (God above man, ruler above subject) reproduce social stratification as divinely willed. Mahmood warns that piety movements can generate forms of agency that reinforce, rather than resist, domination: individuals cultivate virtues of patience and humility aligned with authoritarian morality (32, p.9). Similarly, Butler argues that subjection is productive—it forms the subject through the very act of submission (14, p.13). Religious obedience thus becomes a technology of the self, producing compliant but morally fulfilled citizens.

This moralisation of obedience renders resistance not only dangerous but sinful. The authoritarian order becomes an ethical cosmos; to question it is to disrupt the moral universe. As Asad observes, secular and religious power alike function by shaping sensibilities—how subjects feel about virtue, duty, and belonging (6, p.34). The success of authoritarianism lies in this affective dimension: people come to love their obedience, to find comfort in constraint.

Coercion, Consent, and the Theological State

Authoritarian religion operates along a spectrum of coercion and consent. Some religious institutions cooperate willingly, seeing the regime as protector of faith; others are compelled through repression or co-optation. Yet in both cases, the result is a moral economy of loyalty. Marshall describes how Pentecostal movements produce self-governing believers who internalise neoliberal and authoritarian logics under the guise of spiritual renewal (33, p.211). The same structure applies globally: religion translates political subjection into moral discipline, ensuring that control is lived rather than imposed.

This process blurs the boundary between secular and sacred authority. Agamben highlights how modern states inherit theological models of governance (1, p.57). Sovereignty and salvation intertwine; obedience becomes both political and eschatological. Religion thus supplies authoritarianism with what ideology alone cannot provide: moral legitimacy that feels eternal.

Conclusion: The Sacred Logic of Obedience

Religion completes the transformation of coercion into consent by adding a third dimension: moral sanctification. Fear controls bodies; ideology controls minds; religion controls consciences. By embedding obedience within moral and spiritual frameworks, regimes achieve durability through devotion. The citizen is no longer merely ruled but redeemed by participation in the order.

Religion's power lies in its invisibility: it shapes not through decrees but through the moral texture of everyday life—rituals, virtues, duties, and fears of transgression. It turns submission into righteousness and suffering into sacrifice. Authoritarianism survives not by repressing freedom but by redefining it—transforming political loyalty into moral truth.

1.4 Secularism and Its Limits

While secularism arose as a promise of liberation from religious domination, it does not automatically prevent moral or psychological forms of control. Modern secular regimes often reproduce mechanisms of internalised authority—through civic norms, civil religion, and moralised conceptions of rationality—transforming rather than eliminating the subtle regulation of behaviour and belief. This section evaluates how secular governance can still produce compliance and moral normalisation, allowing comparison with religiously infused regimes.

The modern ideal of secularism emerged as a response to theocratic domination—a political project designed to liberate human reason, conscience, and governance from ecclesiastical authority. Enlightenment thinkers envisaged the secular state as a realm of neutrality, in which individual belief and civic belonging could coexist without coercion. In this vision, secularism promised emancipation from dogma and the rational organisation of social life. Yet, as Habermas (29) and Taylor (39) remind us, the secular age did not eliminate the need for meaning; rather, it reconfigured it. What was once sacred was relocated into the moral, civic, and institutional order itself. This chapter examines whether secularism genuinely avoids the mechanisms of moral normalisation observed in religious regimes—or whether it merely substitutes one form of sanctity for another.

The Secular Promise: Autonomy and Rational Order

Classical secularisation theory, exemplified by Weber's notion of Entzauberung ('disenchantment'), proposed that modernity entails the progressive rationalisation of all spheres of life. Religion, once the matrix of meaning, would recede as science and reason provided new foundations for legitimacy (40). Casanova later reformulated this thesis, arguing that secularisation involves three interrelated processes: the differentiation of social spheres, the decline of religious authority, and the privatization of faith (15). In principle, these processes should protect political systems from sacralised power. Habermas (29) extended this ideal into his vision of a post-secular society—in which religious and secular citizens engage in "translation" between moral languages within a shared rational discourse. Secularism thus aspires not merely to separate church and state but to foster communicative rationality as a counterweight to dogma and coercion.

In this liberal formulation, secularism functions as the moral infrastructure of democracy: it promotes tolerance, autonomy, and pluralism by displacing absolute moral authority with procedural norms. For Taylor (39), secular modernity represents a "shift in the conditions of belief"—not the disappearance of faith, but its transformation into a personal and optional choice. The public realm, ideally, becomes a space governed by reasoned argument rather than divine command.

Yet this self-image of neutrality conceals subtler forms of moral power. Even in its emancipatory guise, secularism may operate as an instrument of normalisation—shaping the moral field within which individuals perceive themselves as free, rational, and modern. The secular state, in other words, can reproduce what Foucault (22) described as the subtle coercion of "governmentality": the internalisation of norms defining what counts as acceptable reason, virtue, or progress.

Civil Religion and the Secular Sacred

Bellah's (8) concept of civil religion exposes a central paradox of secular modernity: societies that renounce theological authority frequently construct secular equivalents of the sacred. The nation, the constitution, or the market becomes the object of collective reverence. Rituals such as national holidays, memorials, and anthems sacralise the political community itself, generating collective meaning and moral legitimacy. Similarly, Gauchet (24) described modernity as "the religion of the exit from religion"—a civilisation that internalises the religious impulse into its political institutions.

Secularism, therefore, does not abolish the sacred; it transposes it. Asad (5) critiques the Western model of secularism as a moral-political formation that delineates the proper boundaries of faith, reason, and emotion—a system privileging certain modes of subjectivity while excluding others. The secular subject is disciplined to believe in the neutrality of law and reason, yet these values carry their own normative weight. In this sense, secularism is not merely a framework for co-existence but a regime of truth that prescribes what counts as legitimate knowledge and moral feeling.

Žižek (44) adds a psychoanalytic dimension: secular ideology functions as an "invisible religion," demanding belief in progress, democracy, or the market as transcendent ideals. These beliefs, though formally secular, bind the subject through moral conviction. Secularism, then, substitutes the priest with the expert, the sermon with technocratic rationality, and faith with statistical certainty. The result is not the disappearance of belief but its redistribution across new institutional forms.

The Limits of Secular Neutrality

The critical question is whether secularism genuinely prevents domination, or whether it merely disguises new hierarchies under the banner of rationality. Brown (12) argues that neoliberalism has transformed secular ideals of autonomy and tolerance into instruments of depoliticisation: citizens are recast as entrepreneurial subjects, responsible for their own moral worth and failure. In this "market theology," the invisible hand assumes a quasi-divine logic, rewarding virtue and punishing vice. Similarly, Connolly (18) observes that secularism often enforces its own moral orthodoxy—the belief in rational consensus—which marginalises affect, spirituality, and dissent as irrational residues of premodern life.

Such critiques reveal that the secular project, far from neutral, establishes its own sacred order: a faith in reason, progress, and civility that functions as a moral technology of governance. Sloterdijk (37) calls this the "anthropotechnics" of modernity—the self-cultivation of subjects who internalise civic virtues, productivity, and self-control as secular ascetic practices. The individual who disciplines herself in the name of efficiency or civic duty is analogous to the believer who renounces

temptation for divine grace. Both exemplify the internalisation of moral power.

Re-Enchantment and the Return of the Sacred

If secular modernity sought to disenchant the world, recent decades have witnessed a counter-movement toward re-enchantment. Taylor (39) and Casanova (16) note that religion and spirituality persist—not in opposition to modernity, but as responses to its moral vacuum. In post-secular societies, religious and secular values intermingle, often producing hybrid ideologies that blend moral conviction with political control. Populist nationalism, for instance, fuses civil religion with theological symbolism, portraying the nation as a chosen people under siege.

In this context, secularism's limits become evident: even without formal religion, societies remain vulnerable to the moralisation of power. The same psychological mechanisms that once sustained religious obedience—guilt, duty, sacrifice, and loyalty—can be mobilised by ostensibly secular ideologies. When rationality itself becomes moralised, dissent appears not merely mistaken but heretical. The line between faith and reason is less a boundary than a translation—constantly reconfiguring the sacred in political form.

Conclusion

Secularism arose as a promise of liberation, yet its very success has created a new moral order. By defining the boundaries of legitimate belief and rational conduct, secularism participates in the same dynamics of normalisation that underpin religious regimes. The authoritarian danger lies not in religion alone but in the human tendency to sacralise authority—to convert obedience into virtue. Whether under divine or secular banners, the challenge remains the same: to preserve spaces of critical distance where belief, morality, and power do not collapse into one another.

Chapter II: Methods, Results and Discussion

2.1 Methodology

This study employs a theoretical and interpretive methodology to examine the invisible mechanisms of control in authoritarian regimes, focusing on how these mechanisms operate through coercion, ideology, and moralization. Rather than collecting empirical data, the research synthesizes and critically analyzes existing literature from political philosophy, sociology, and comparative political studies. The aim is to construct a comprehensive conceptual framework that explains how authoritarian durability depends not merely on fear or repression, but on the moral and ideological internalization of obedience.

Research Design

The study adopts a critical-constructivist approach, which assumes that social reality is not simply given but actively constructed through ideas, institutions, and moral norms. This perspective allows for the integration of philosophical theory, sociological insight, and political analysis to understand how power functions at multiple levels—material, symbolic, and ethical. The analysis proceeds diachronically, tracing the evolution of thought on authoritarianism from classical theorists to contemporary scholars, while incorporating cross-disciplinary perspectives on religion, ideology, and culture.

A conceptual literature synthesis guides the research. The study systematically reviews scholarship on totalitarianism, cultural hegemony, governmentality, and political theology to identify the mechanisms through which obedience is normalized. The synthesis emphasizes three dimensions of control—coercive, ideological, and moral—demonstrating how authoritarian regimes progressively shift from external enforcement to internalized compliance. This approach allows for the construction of an integrated model of moralized obedience grounded in both theoretical and comparative analysis.

Corpus and Scope

The research draws upon both classical and contemporary sources, selected for their conceptual relevance to authoritarian control. The study is global in scope but selective in focus, examining regimes in which religion, ideology, and state authority intersect to maintain social order without privileging particular nations or regions. By emphasizing general patterns rather than specific case studies, the analysis produces insights that are conceptually transferable and theoretically relevant across a variety of authoritarian contexts.

The study employs conceptual analysis and comparative synthesis as its primary analytical tools. The analysis is both interpretive—seeking to understand the meaning structures imposed by authoritarian regimes—and critical—assessing the ethical and social consequences of these mechanisms. Through this synthesis, the study develops a conceptual model of "moral normalization", demonstrating how fear, ideology, and religious or quasi-religious frameworks collaborate to sustain long-term obedience.

Limitations

The methodology has several inherent limitations. The reliance on secondary sources means that the analysis cannot capture the lived experiences of obedience or moralization directly; rather, mechanisms are inferred from existing scholarship and documented patterns. The selection of theoretical perspectives is necessarily limited, and while it includes a range of canonical and contemporary voices, it cannot encompass the full diversity of political, cultural, and religious contexts. Additionally, the focus on ideological and moral dimensions may underemphasize other factors of control, such as economic coercion, surveillance technologies, or informal social networks.

Despite these limitations, the approach provides a systematic and conceptually rigorous framework for understanding how authoritarian regimes extend control beyond coercion. By integrating philosophical, sociological, and political perspectives, the study produces a robust theoretical model that can inform future research and serve as a foundation for empirical investigation into the moral and ideological mechanisms of obedience.

2.2 Results:

This study set out to investigate how authoritarian regimes transform obedience from a political necessity into a moral virtue. The analysis of theoretical and interpretive literature reveals a consistent conceptual trajectory: from coercion to consent, and from consent to

moral normalisation. The results show that authoritarian control does not rely exclusively on repression, but on the internalisation of legitimacy through institutions, symbols, and moral vocabularies that render domination ethically meaningful.

Building on this insight, the study conceptualises authoritarian control as a dynamic, multi-layered process. At the first layer, coercion—manifested through surveillance, punishment, and repression—produces immediate fear-based compliance, but this alone is insufficient for long-term regime stability. The second layer involves consent, where ideology, aesthetics, and performative practices generate affective identification with the system, embedding obedience in everyday culture. The third, most enduring layer is moral normalisation: religious, ethical, or institutional frameworks internalise the values of the regime, transforming obedience into perceived virtue. In this configuration, individuals follow rules not merely out of fear or interest but because the social and moral environment signals that compliance is the "right" and natural course of action. These layers interact dynamically rather than sequentially—coercion initiates compliance, cultural mechanisms reinforce it, and moral internalisation sustains it over time. Crucially, religion often embodies this third layer, providing a communicative and moral structure that naturalises political obedience. Secular regimes, while formally neutral, may replicate the same mechanisms, substituting ideological, bureaucratic, or civic rituals for religious moralisation. This framework emphasises that the durability of authoritarian rule depends not on visible coercion alone but on the invisible normalisation of behaviour, thought, and moral perception.

From Coercion to Consent

At its most visible level, authoritarian power operates through coercion—discipline, surveillance, and punishment. This is the domain traditionally analysed by political science: the repressive apparatus that enforces obedience through fear (3, 42). Yet, as these scholars note, coercion alone produces only fragile compliance. It silences but does not persuade; it suppresses opposition but cannot generate conviction. Fear disciplines the body but leaves the conscience unconvinced.

The durability of authoritarian rule therefore depends on a second, less visible layer of control: consent. Building on Gramsci's (27) notion of hegemony and Althusser's (2) concept of ideological apparatuses, the study shows that regimes secure obedience by constructing a world of meanings in which subordination appears rational, patriotic, or even benevolent. Through schools, media, and cultural institutions, rulers manufacture consent by shaping citizens' moral expectations and emotional attachments. As Foucault (21, 22) demonstrated, power increasingly migrates from the juridical to the normalising—governing through discipline rather than decree.

From Consent to Moral Normalisation

A third and deepest layer emerges when consent is moralised. Authoritarian orders achieve permanence once obedience is transformed from a pragmatic accommodation into an ethical good. Religion, as both institution and symbolic system, provides the most effective template for this transformation. It offers moral vocabularies—sin, duty, loyalty, sacrifice—that enable regimes to reframe compliance as virtue. Drawing on Durkheim's (19) insight that religion expresses society's moral order, and Weber's (41) analysis of legitimacy, the study finds that religious language sacralises power, presenting hierarchy as divinely ordained and submission as righteous.

This process can be understood as three interwoven layers of control. The first, coercion, operates through surveillance and punishment, producing fear-based obedience. The second, consent, functions through ideology, aesthetics, and ritual performance, generating affective attachment to the regime. The third, moral normalisation, embeds obedience within ethical and religious frameworks so that submission appears as virtue rather than constraint.

These layers interact dynamically rather than sequentially: fear may initiate compliance, but consent and moral normalisation make it enduring. Together they transform domination into everyday normalcy, ensuring that authoritarian power persists not through constant repression, but through its integration into the moral and emotional life of the governed.

Religion and the Sacred Logic of Obedience

The findings further demonstrate that religion functions not merely as an ideological tool but as a moral technology of the self (22). Through ritual, confession, and conscience, religious institutions teach individuals to govern themselves. Authoritarian regimes appropriate this pastoral logic by merging political obedience with spiritual duty. As Asad (4) and Mahmood (32) observe, piety becomes a medium of power: subjects willingly discipline themselves in the name of virtue.

Religion thus operates as both communicative infrastructure and ethical framework. It legitimises authority through transcendence, while simultaneously producing self-governing subjects. The result is a polity in which control is lived as moral fulfilment rather than constraint.

Secularism and the Persistence of the Sacred

Finally, the analysis shows that secularism does not abolish these dynamics; it transforms them. Civil religion (8) and what Asad (5) calls "the secular formation" reveal that modern societies continue to sacralise political authority—transposing religious emotions onto civic ideals such as the nation, the market, or progress. Secularism's promise of neutrality conceals a new regime of moral power, one that defines legitimate reason and virtue while marginalising alternative moralities (39, 12). The "secular sacred" reproduces the same invisible mechanisms of obedience, now couched in the idioms of rationality and civility.

Taken together, these findings confirm the central thesis: fear alone is insufficient to sustain authoritarian rule; durability arises when obedience is moralised and internalised. Authoritarianism endures not merely by controlling bodies but by shaping consciences—when subjection is lived as ethical conviction, and power becomes indistinguishable from virtue.

2.3 Discussion and Future Research Directions

The results illuminate why authoritarian regimes often survive crises that would delegitimise purely coercive systems. Economic failure, corruption, or repression may provoke discontent, yet citizens remain bound by moral and affective ties that transcend rational evaluation. When obedience is equated with faith or patriotism, dissent appears not only risky but immoral. This moralisation of loyalty blurs the boundary between ruler and ruled: citizens become co-producers of domination, policing themselves and one another in the name of virtue.

This dynamic helps explain the resilience of contemporary "information autocracies" (28), where overt violence is rare but conformity remains widespread. The regime's success lies less in censorship than in its capacity to define what is morally permissible to think and feel. As Lukes (31) argued, the most profound form of power is the ability to shape preferences so that people do what power requires because they believe it is right.

The Affective Economy of Normalisation

The study also exposes the affective dimension of authoritarian stability. Citizens do not simply accept power intellectually; they feel it as security, belonging, or righteousness. Drawing on Giddens's (26) notion of ontological security, the analysis suggests that regimes provide psychological comfort by promising order amid uncertainty. Fear of chaos is replaced by trust in authority, even when that authority is oppressive. The emotional satisfaction of moral clarity often outweighs the discomfort of critical doubt.

Aesthetics and ritual reinforce this affective economy. The monumental architecture, national ceremonies, and moralised media identified in earlier sections function as sensory pedagogy. They teach obedience through beauty and rhythm, producing what Buck-Morss (13) called a "sensual politics." The subject's attachment to power becomes embodied—an aesthetic and emotional habitus (11) that feels natural.

The Secular Paradox

A striking implication of the findings is that secularism offers no automatic safeguard against moralised domination. By defining its own criteria of rational virtue, the secular state can reproduce the same structure of obedience it claims to transcend. The worship of reason, progress, or market freedom can serve as new forms of faith, demanding devotion and sacrifice. As Žižek (44) provocatively argues, ideology functions as an "invisible religion," organising belief even in the absence of gods.

This secular moralisation often manifests through bureaucratic and technocratic institutions. Education systems, for instance, cultivate civic virtue and self-discipline as moral goods. Bureaucracies reward compliance and efficiency as ethical ideals. These institutions, though ostensibly rational, operate as secular churches—training citizens to internalise norms that sustain the system. The ethical subject of liberal modernity thus mirrors the pious subject of religious authoritarianism: both find moral worth in obedience.

Resistance and Visibility

Recognising these invisible mechanisms has ethical and political implications. If domination persists because it is misrecognised as virtue, resistance must begin by denaturalising the moral order. Critical theory, art, and education can expose the contingent nature of what appears sacred or rational. Following Arendt (3), the task is to reopen the "space of politics" destroyed by fear and moral certainty—to restore plurality, spontaneity, and judgment.

Yet such resistance cannot rely solely on rational critique. Since authoritarian normalisation operates through affect and conscience, emancipatory practices must also engage emotion and imagination. The challenge is to cultivate forms of ethical reflection that do not collapse into moral obedience—to imagine virtue without submission, faith without servitude.

Directions for Future Research

Future scholarship might explore how secular institutions reproduce moralised obedience through non-religious means. Comparative studies of education, bureaucracy, or technocratic governance could illuminate how civic virtues such as diligence, civility, or patriotism operate as moral technologies of control. Interdisciplinary dialogue between political theory, sociology of religion, and affect studies could further clarify how emotional life sustains ideological structures.

A promising avenue lies in the philosophical project tentatively called "Ethical Freedom: Rethinking Power Beyond Fear and Faith." Such research would move from diagnosis to reconstruction—investigating how moral agency can be reclaimed from both authoritarian moralism and secular instrumentalism. It would seek forms of freedom grounded not in the absence of belief, but in the reflexive awareness of how belief itself becomes a site of power.

Conclusion

Fear creates compliance, but it does not create legitimacy. The stability of authoritarian regimes depends on their ability to transform obedience into moral truth. Through ideology, ritual, and particularly religion, domination is sanctified: it ceases to appear as coercion and is experienced as virtue. Churches, mosques, and temples function as moral technologies—shaping conscience and turning political loyalty into a sense of sacred duty.

Secular modernity, however, replicates this logic in new forms. When the state, the nation, or the market assumes a quasi-sacred status, citizens internalise obedience as rational responsibility. The supposed neutrality of secularism thus conceals a deeper moral governance: a framework that defines what counts as virtue, reason, and progress. In practice, sacred and secular authority differ more in form than in function, both relying on subtle mechanisms that make power self-sustaining.

This analysis has two key implications. First, authoritarianism should be understood not merely as repression, but as the moral education of subjection, shaping the inner life of citizens—their values, emotions, and sense of the good. Second, critique must extend beyond institutions to the affective and ethical structures that produce consent.

Resistance begins by making these invisible mechanisms visible: by unmasking the sanctity of obedience and reclaiming the ethical capacity to question it. The goal is not to abolish morality or faith, but to free them from domination. As long as obedience continues to masquerade as virtue—whether in the name of God, the nation, or reason—authoritarianism will find fertile ground in the human desire for moral certainty.

The ultimate challenge, then, is to imagine freedom beyond fear and faith: an ethical life that neither depends on coercion nor collapses into moralised submission. Only by cultivating a critical conscience capable of questioning its own righteousness can societies hope to disarm the invisible mechanisms that make power appear as truth.

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JURISPRUDENCE

PROTECTION OF CONSUMER RIGHTS IN DISTANCE SELLING CONTRACTS – URGE TO REFORM GEORGIAN PRIVATE INTERNATIONAL LAW

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Abstract

The Association Agreement between Georgia and the European Union has initiated a significant process of legislative approximation, including the recent transposition of Directive 2011/83/EU on consumer rights into Georgian law. Despite this progress in substantive consumer regulation, the protection afforded to consumers in cross-border distance selling contracts remains structurally inadequate at the level of private international law. Presented article delivers interim conclusions from my ongoing PhD thesis on critical analyzes of current framework of the Law of Georgia on Private International Law (GPIL).

The article examines the EU's dual-layered system of consumer protection: a substantive layer, under Rome I, ensuring the application of the consumer's habitual residence law and restricting harmful choice-of-law clauses through a semi-mandatory regime; and a procedural layer, under Brussels Ibis, granting asymmetric jurisdictional privileges, home-forum protection, and tight control over forum-selection clauses. Employing a combination of doctrinal, comparative, teleological, and normative-analytical methods study integrates elements of case-law analysis, focusing on key decisions of the Court of Justice of the European Union the article proposes a comprehensive reform of Georgian private international law and civil procedure.

Keywords: Consumer rights, Private International Law, Substantive Protection, Procedural Protection, Distance Selling,

1. Introduction

The Association Agreement between Georgia and the EU, signed on 27 June 2014 and entered into force on 1 July 2016, gave rise to comprehensive harmonization process of legislature between European Union and Georgia.[1] The conclusion and implementation of such agreements form part of the EU's broader European Neighborhood Policy (hereinafter, the "ENP"), which aims to deepen integration with its eastern partner states, including Georgia.[2] Integration in sphere of protection of consumer rights was reflected in adoption of law of Georgia on the protection of consumer rights, corresponding obligation on implementation Directive 97/7/EC of the European Parliament and of the Council of 20 May 1997 on the protection of consumers in respect of distance contracts, prescribed by the Association Agreement between Georgia and the EU.[3] Since, approximation of legislation took place in 2022, Parliament of Georgia surpassed minimum obligation of harmonization and transpositioned Directive 2011/83/EU of the European Parliament and of the Council of 25 October 2011 on consumer rights, amending among others, Directive 97/7/EC of the European Parliament and of the Council.[4]

In the light of latest legislative developments in the sphere of consumer rights, protection mechanisms offered in cross-border consumer transactions are still weak. Particularly, Georgian law on private international law (GPIL) although ensures mandatory protection for consumers, the protection afforded by Article 38 of GPIL remains insufficient for achieving that goal – it fails to meet attested standards of EU, including Rome I regulation[5] and leaves consumers vulnerable in cross-border distance selling contracts.

2. Notion of Consumer under European PIL

[1] Association Agreement between the European Union and the European Atomic Energy Community and their Member States, of the one part, and Georgia, of the other part, OJ L 261, 30.8.2014, pp. 4–743, https://eur-lex.europa.eu/eli/agree_internation/2014/494/oj/eng , accessed <09.12.2025>

[2] Pieter Jan Kuiper, Jan Wouters, Frank Hoffmiester, Geert De Baere and Tomas Ramopoulos, The Law of EU External Relations: Cases Materials and Commentaries on the EU as an international Legal Actor (2nd edn, Oxford University Press) 556.

[3] Annex XXIX to the Association Agreement between the European Union and the European Atomic Energy Community and their Member States, of the one part, and Georgia, of the other part, OJ L 261, 30.8.2014, pp. 4–743, https://eur-lex.europa.eu/eli/agree_internation/2014/494/oj/eng , accessed <09.12.2025>

[4] Directive 2011/83/EU of the European Parliament and of the Council of 25 October 2011 on consumer rights, amending Council Directive 93/13/EEC and Directive 1999/44/EC of the European Parliament and of the Council and repealing Council Directive 85/577/EEC and Directive 97/7/EC of the European Parliament and of the Council Text with EEA relevance, https://eur-lex.europa.eu/eli/dir/2011/83/oj/eng , accessed <09.12.2025>

[5] Gogichaishvili, E. (2018) 'Comparative Analysis of Consumer Protection Under the Law of Georgia on Private International Law and the Rome I Regulation', Georgian Law Journal, 2(1).35-36.

Protective jurisdictional regime on consumer rights stablished by the Brussels Ibis Regulation[6] is designed on the concept of consumer, as **jurisdictional gatekeeping device** designed to protect weaker parties in cross-border contractual disputes. The definition is restrictive, autonomous, and interpreted in light of its purpose—to protect the weaker party.[7] **Imbalance of bargaining power** between professionals and individuals acting outside their trade, urges European Court of Justice to interpret definition of consumer strictly but purposively. As it is reflected in ***Benincasa v. Dentalkit,*** even if future activities of the party entering the commercial arrangement were not yet commenced, could not qualify as a consumer because protection is confined to "private final consumption."[8] Similarly, ***CJEU*** refined the notion of "mixed-purpose contracts," stating that the consumer status applies only if the professional purpose is marginal. In other words, Gruber doctrine states that if a contract has both private and professional elements, consumer status exists only if the professional aspect is so negligible that it "plays no part at all.[9] Moreover, later case law confirms the principle: commercial activity even if ancillary—disqualifies consumer status.[10]

Key implications of Brussels Ibis Regulation on consumer implies that **only natural persons** qualify as consumers, purpose of transaction should be determined objectively and burden of proof lies with the party invoking consumer status.[11]

With respect to distance selling contracts, requirements of internationality and cross-border element in private contracts attested in previously established case law,[12] specifies additional yardsticks to measure scope of application of Brussels I/ibis regime. Specifically, cross-border online consumer contract should satisfy three prerequisites. Firstly, trader should envisage doing business in state of that consumer's domicile, in the sense that it was minded to conclude a contract with them. Secondly, international nature of trader's activity should entail use of language or a currency of the state of consumer's domicile, other than the language or currency generally used in the Member State in which the trader is established with the possibility of making and confirming the reservation in that other language, mention of telephone numbers with an international code, outlay of expenditure on an internet referencing service in order to facilitate access to the trader's site or that of its intermediary by consumers domiciled in other Member States, use of a top-level domain name other than that of the Member State in which the trader is established, and mention of an international clientele composed of customers domiciled in various Member States. Thirdly, mere accessibility of the trader's or the intermediary's website in the Member State in which the consumer is domiciled is insufficient.[13]

Moreover, contract still may be concluded offline if initial targeting was online[14] and causal link between online targeting and conclusion of contract is not required, to establish conclusion of distance consumer contract.[15]

To conclude, Articles 17-19 of Brussels Ibis regulation and practice of CJEU, makes it evident that notion of consumer under European international private law, should be interpreted strictly, according to narrow definition of the legislation. It has autonomous meaning under EU law, including recently developed practice of CJEU. Moreover, on case-by-case bases, notion shall not be precluded from teleological interpretation and functionality of purpose of the contract under consideration.

Similarly, EU's commitment to the weaker party doctrine is reflected in Article 6 Rome I regulation, which established special choice of law rule for consumer contracts, that structurally parallels Articles 17–19 Brussels Ibis, though it governs applicable law rather than jurisdiction.[16] Article 6 applies only where one party is a consumer, meaning a natural person acting outside his trade or profession, echoing general approach of EU towards definition of the notion of consumer, which should be acknowledged as strictly functional and must be interpreted autonomously.[17] Such approach, excludes from the notion legal persons, natural persons acting for business purposes, even if economically weak, individuals engaged in preparatory entrepreneurial activity.[18]

Scope of application of Rome I regulation is circumcised to the consumer contracts explicitly listed in the regulation as follows: sale of goods, supply of services, consumer credit, contracts concluded with a professional who **directs activities** to the consumer's state.[19] Therefore, Article 6 must not be expended beyond its explicit text and apply to exemptions listed[20] in the text or otherwise.[21]

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[6] European Parliament and Council (2012) Regulation (EU) No 1215/2012 (Brussels Ibis Regulation).Article 17-19;

[7] Magnus U., Mankowski P., 2016. European Commentaries on Private International Law (ECPIL), Brussels Ibis Regulation Commentary, 343-344.

[8] Benincasa v. Dentalkit (Case C-269/95)

[9] Gruber v. BayWa (Case C-464/01)

[10] ECJ, Schrems v Facebook, Case C-498/16

[11] Magnus U., Mankowski P., 2016. European Commentaries on Private International Law (ECPIL), Brussels Ibis Regulation Commentary, 443-454.

[12] Hypotecni bank a.s.v. Udo Mike Lindner (Case C-327/10), [2011] ECR I-11543 para.29; Armin Maletic and Marianne Maletic v. lastminute.com GmbH and TUI Osterreich GmbH (Case C-478/12), ECLI:EU:C:2013:735 para. 25;

[13] Pammer and Hotel Alpenhof (Joined Cases C-585/08 and C-144/09).

[14] Mühlleitner (C-190/11);

[15] Emrek (C-218/12);

[16] Magnus, U. (2017) 'Art 6 Rome I', in Magnus, U. & Mankowski, P. (eds) European Commentaries on Private International Law: Rome I Regulation. Munich: Sellier, p 453.

[17] Ibid, p 458.

[18] Ibid, pp 458–459.

[19] European Parliament and Council (2008) Regulation (EC) No 593/2008 (Rome I Regulation), article 6(1).

[20] Article 6(4) excludes from the scope transportation contracts, save for package tours. Contracts covering financial instruments outside retail settings and insurance contracts (covered separately) are out of scope of the Rome I Regulation.

[21] **Magnus, U.** (2017) 'Art 6 Rome I', in Magnus, U. & Mankowski, P. (eds) ***European Commentaries on Private International Law: Rome I Regulation***. Munich: Sellier, p 455.

Both Rome I and Brussels Ibis adopt an autonomous concept of consumer, defined as a natural person acting for purposes outside his trade or profession.[22] Term "consumer" is a strictly functional concept, determined by the purpose of the contract rather than the subjective status of the party,[23] derived from the normative premise that consumers are typically less informed, less powerful, and less capable of negotiating favorable contractual terms than professionals are – such protection embodies a "structural asymmetry", justified by the imbalance of information and bargaining power.[24]

3. Concept of Consumer under Georgian PIL

The Law of Georgia on Public International Law explicitly recognizes the importance of protecting consumer rights. Article on "Imperative rules of social protection" provides: "The choice of law shall be considered void if it disregards the imperative rules that are adopted to protect customers and employees from discrimination. This rule shall also apply to the delivery and financing of movable property, or labour or service contracts if they are agreed upon or concluded in a country in which the customers and employees have their place of residence and where these protective rules operate."[25]

Although first sentence of Article 38 demonstrates that parties retain autonomy to choose the applicable law, including in consumer contracts, such choice is limited by mandatory protective norms. Its main objective is to protect the consumer from discriminatory treatment—any choice of law leading to discrimination against the consumer will be null and void, and the national law will govern the contract instead. Addressing only discrimination-based violations, mechanism afforded by Article 38 remains insufficient to ensure mandatory protection for consumers, since consumer interests extend beyond the issue of discriminatory treatment. [26]

Unlike explicit and clear definitions of notion of "consumer" provided by acts of European PIL ("person outside his trade or profession"),[27] the Law of Georgia on Private International Law fails to articulate a clear, coherent, and operational definition of the concept of a "consumer," thereby creating interpretative uncertainty and limiting doctrinal consistency in the application of consumer-protective conflict-of-law rules.

The Law of Georgia on the Protection of Consumer Rights defines the consumer as "any natural person who is offered goods or services, or who purchases or further consumes goods or services exclusively for private purposes and not for performing any commercial practice or industrial activity, crafting or other occupational activities."[28] Yet, notwithstanding the presence of this sector-specific formulation, the autonomous incorporation of the consumer notion into the Law of Georgia on Private International Law remains indispensable. The GPIL operates within a distinct normative and methodological domain—namely, the allocation of legislative competence and the calibration of party autonomy in cross-border contractual settings—where the classification of a party as a consumer must be shaped by PIL-specific criteria.[29] These include the existence of an international element, a contract-specific and purpose-sensitive analysis of the party's role, and the narrow, exception-based interpretative approach traditionally demanded by protective conflict-of-laws rules.[30] Although the CPR Law definition closely reflects the structure and language of the consumer concept developed in the Rome I and Brussels Ibis Regulations, this parallelism cannot substitute for a clearly articulated and functionally autonomous definition embedded within the GPIL itself. Only such a PIL-tailored notion can safeguard doctrinal coherence, ensure genuine harmonization with European private international law standards, and provide the degree of legal certainty and predictability required for Georgia's evolving conflict-of-laws jurisprudence.

4. Two folded system of consumer protection

European private international law constructs consumer protection on a dual foundation: substantive protection, provided primarily by Article 6 of the Rome I Regulation, and procedural protection, enshrined in Articles 17–19 of the Brussels Ibis Regulation. These instruments operate simultaneously yet independently, each addressing distinct vulnerabilities inherent in cross-border consumer transactions. Substantive protection secures the content of consumer rights by ensuring the application of mandatory consumer law, while procedural protection guarantees a fair and accessible forum in which those rights may be enforced. The architecture is described by Briggs as a "two-lane but

[22] Magnus, U. (2017) 'Art 6 Rome I', in Magnus, U. & Mankowski, P. (eds) European Commentaries on Private International Law: Rome I Regulation. Munich: Sellier 458; 11.Magnus, U. & Mankowski, P. (2016) European Commentaries on Private International Law: Brussels Ibis Regulation Commentary. Munich: Sellier, p 443.

[23] Magnus, U. (2017) 'Art 6 Rome I', in Magnus, U. & Mankowski, P. (eds) European Commentaries on Private International Law: Rome I Regulation. Munich: Sellier, p 458-460.

[24] Basedow J., 2008, Consumer Protection in PIL, European Review of Private Law (ERPL), Vol. 10, p. 833

[25] The Law of Georgia on Public International Law, Article 38. https://matsne.gov.ge/en/document/view/93712?publication=6 , accessed <10/12/2025>

[26] Gabisonia Z., Kartuli Saertashoriso Kerdzo Samartali [Georgian Private International Law] (Meridiani, 2011) pp 301-302.

[27] Regulation (EU) No 1215/2012 of the European Parliament and of the Council of 12 December 2012 on jurisdiction and the recognition and enforcement of judgments in civil and commercial matters (recast), Article 17(1); Regulation (EC) No 593/2008 of the European Parliament and of the Council of 17 June 2008 on the law applicable to contractual obligations (Rome I), Article 6(1).

[28] Law of Georgia On the Protection of Consumer Rights, Article 4 (i), 1455-VIIIმს-Xმპ, 29/03/2022. https://www.matsne.gov.ge/en/document/view/5420598?publication=0

[29] Cachia P., 2009, Consumer Contracts in European Private International Law, European Law Review, 34(3): pp 480–481.

[30] Max Planck Institute (2007) 'Comments on the Commission's Proposal for Rome I Regulation', Rabels Zeitschrift für ausländisches und internationales Privatrecht, pp 230-233.

tightly interlocked system,"[31] and by Tang as a "complementary equilibrium between justice in substance and justice in access."[32] The following subparagraphs analyse these two dimensions in detail, explaining how they operate, the principles underlying them, and how they can reinforce reform of Georgian PIL.

4.1.Substantive Protection Under Article 6 of the Rome I Regulation

Substantive protection delivered through Article 6 Rome I, ensures that consumers—defined strictly as natural persons acting outside their trade or profession—cannot be deprived of the substantive safeguards of their habitual residence, regardless of any contractual choice-of-law clause. This is the doctrinal core of the system and reflects the EU's recognition that consumers possess weaker bargaining power and typically lack the expertise to assess the implications of foreign governing law. Central to Article 6 is the principle that the law of the consumer's habitual residence applies by default.[33] Habitual residence represents not only the consumer's social and legal environment but also the jurisdiction whose norms the consumer can reasonably expect to apply. This "expectation principle" is essential to the legitimacy of consumer PIL: consumers transact within a psychological and informational bubble shaped by their domestic law.[34]

The second pillar of substantive protection prescribed by the act is the semi-mandatory nature of party autonomy: while parties may choose an applicable law, such choice cannot deprive the consumer of the protection provided by the mandatory provisions of their habitual residence.[35] Academic writers have aptly described this as a "double filter" or "dual-application model": the chosen law applies in principle, but mandatory consumer-protective rules from the habitual residence override it where necessary.[36] This system prevents evasion of stronger consumer standards and curtails regulatory arbitrage. Case law reinforces this model, ensuring that the regime is not exploited by traders or by individuals attempting to self-categorize strategically.[37]

A crucial component of Article 6's substantive protection is the directed activity requirement. Traders must direct or pursue commercial activity toward the consumer's state, and the contract must fall within such activity, identifying factors such as multilingual websites, use of foreign currencies, or shipping policies as indicators of directed activity.[38] In Emrek, the Court clarified that no causal link is needed between the directed activity and the consumer's decision to contract, a highly protective approach that expands substantive protection even in digitally diffuse markets.[39] These judgments are observed as "future-proof" consumer law for e-commerce, where consumer behavior is often serendipitous and not easily attributable to singular advertising triggers.[40]

4.2.Procedural Protection

If substantive protection ensures what rights consumers possess, procedural protection ensures where and how those rights may be enforced. Hallmark of Articles 17–19 Brussels Ibis is jurisdictional asymmetry: consumers may sue the professional either in the professional's domicile or in their own domicile, but professionals may bring proceedings only in the consumer's domicile.[41] This asymmetry reflects the recognition that litigation abroad imposes financial, linguistic, logistical, and psychological burdens on consumers that professionals are structurally better positioned to bear. In other words, economic realities of cross-border litigation—translation costs, travel expenses, and differences in legal representation—create formidable barriers that procedural rules must counterbalance if consumer protection is to be effective.[42]

In doctrinal terms, Brussels Ibis secures three procedural pillars: home forum privilege, forum actoris prohibition for professionals, and limited validity of jurisdiction clauses. The home forum privilege means consumers cannot be forced to litigate in a foreign forum; Article 19 provides that jurisdiction clauses in consumer contracts are valid only if concluded after the dispute has arisen or if they confer additional rights on consumers.[43] This approach based on the premise that consumers cannot meaningfully consent to jurisdictional disadvantage in pre-dispute contracts.[44]

The interaction between Rome I and Brussels Ibis forms a unified European model of consumer PIL. Their mutual reinforcement is reflected in "integrated model of consumer justice," wherein conflict-of-laws rules and jurisdictional rules must be interpreted together as part of a broader constitutional structure of fairness.[45]

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[31] Briggs, A. (2019) Private International Law in English Courts. Oxford: Oxford University Press, pp 710–715.

[32] Tang, Z.S. (2015) Electronic Consumer Contracts in EU Private International Law. Oxford: Hart Publishing, pp 3–7.

[33] European Parliament and Council (2008) Regulation (EC) No 593/2008 (Rome I Regulation), Art 6(1).

[34] Magnus, U. (2017) 'Art 6 Rome I', in Magnus, U. & Mankowski, P. (eds) European Commentaries on Private International Law: Rome I Regulation. Munich: Sellier, p 453.

[35] European Parliament and Council (2008) Regulation (EC) No 593/2008 (Rome I Regulation), Art 6(2).

[36] Dickinson, A. (2010) The Rome I Regulation: The Law Applicable to Contractual Obligations in Europe. Oxford: Oxford University Press, pp. 341–348.

[37] Case C-464/01 ***Gruber v BayWa*** [2005] ECR I-439.

[38] Joined Cases C-585/08 and C-144/09 ***Pammer*** and ***Hotel Alpenhof*** [2010] ECR I-12527.

[39] Case C-218/12 Emrek v Sabranovic [2013] ECLI:EU:C:2013:666.

[40] Tang, Z.S. (2015) Electronic Consumer Contracts in EU Private International Law. Oxford: Hart Publishing, 77-82

[41] European Parliament and Council (2012) Regulation (EU) No 1215/2012 (Brussels Ibis Regulation), Art 18.

[42] Weatherill, S. (2021) EU Consumer Law and Policy. Cheltenham: Edward Elgar, pp 121–128.

[43] European Parliament and Council (2012) Regulation (EU) No 1215/2012 (Brussels Ibis Regulation), Art 19.

[44] Peter Mankowski, 'Consumer Contracts, Arts 17–19' in Brussels Ibis Commentary (Sellier 2016) 444–446.

[45] Nevena Lazić and Alexander Loacker (eds), ***Judicial Cooperation in Civil Matters*** (Springer 2018).

5. Reform of Georgian PIL – strengthening substantive and procedural protection of consumer rights.

In the light of provided research results, reform of Georgian PIL should commence by recognizing the architecture of the EU model. Consumer protection in EU private international law is constructed on two interlocking axes: substantive protection under Article 6 of the Rome I Regulation (benefiting from mandatory rules of the law of their habitual residence)[46] and procedural protection under Articles 17–19 of the Brussels Ibis Regulation (securing home forum, thus preventing jurisdiction clauses and procedural manoeuvring from neutralising the substantive protection secured by Rome I).[47]

5.1. Proposals for substantive reforms

By contrast, GPIL lacks a clear definition of "consumer", does not anchor consumer contracts in the law of the consumer's habitual residence, and affords broad and largely unchecked freedom of choice to traders in designing applicable-law clauses. More significantly, Georgian procedural rules do not provide an asymmetric jurisdiction regime comparable to Brussels Ibis, leaving consumers vulnerable to pre-dispute jurisdiction clauses designating foreign courts that are practically inaccessible.[48] As a result, Georgian consumers can be deprived both of the substantive protections of their own law and of realistic access to justice in their home courts.

Besides, urge for introduction of narrow definition of "consumer" in the image of Article 6 Rome I .argued in paragraph 3 of the presented article, the conflict rule itself should be recast so that habitual residence becomes the central connecting factor. Article 6(1) Rome I designates the law of the consumer's habitual residence as the default applicable law where a professional directs activities to that state and the contract falls within those activities.[49] Habitual residence is not chosen arbitrarily -it reflects the social and regulatory environment in which the consumer lives, forms expectations, and organises their economic life.[50] A possible example of reform wording could be along the following formulation, which tracks the structure of Article 6(1) Rome I and would provide a stable default rule in Georgian law:

"A contract concluded between a natural person acting for purposes outside their trade, business or profession ('consumer') and a person acting in the course of their trade, business or profession ('professional') shall, in the absence of a valid choice of law, be governed by the law of the country in which the consumer has their habitual residence, provided that the professional pursues or directs commercial activities to that country and the contract falls within the scope of such activities."

However, modern consumer conflict-of-laws is not satisfied with a mere choice of connecting factor; Article 6(2) Rome I permits the parties to choose the applicable law but stipulates that this choice may not deprive the consumer of the protection afforded by mandatory provisions of the law of their habitual residence.[51] Which can be described as "mandatory minimum protection rule" that prevents traders from using choice-of-law clauses to export weaker regulatory regimes to consumers,[52] "floor" that party autonomy cannot breach.[53] To remedy described shortcoming in Georgian law on PIL, Article 38 should be amended to state explicitly that any choice of law in a consumer contract cannot reduce the level of protection guaranteed by the mandatory rules of the law of the consumer's habitual residence. In statutory language, this might read:

"The parties may choose the law applicable to a consumer contract. Such choice shall not, however, have the result of depriving the consumer of the protection afforded by the mandatory provisions of the law of the country in which the consumer has their habitual residence."

This reform would bring GPIL into close doctrinal alignment with the EU model and meaningfully restrain the use of aggressive choice-of-law clauses in standard terms.

A further indispensable component of reform is the incorporation of the directed activity requirement to address predicaments with safeguarding consumer rights in distance selling contracts. Both Rome I Article 6 and Brussels Ibis Articles 17–19 apply only where the professional "pursues or directs" activities to the state of the consumer's domicile or habitual residence.[54] Non-exhaustive list of indicators of directed activity, such as the use of foreign-language websites, foreign currencies, explicit references to foreign customers, or delivery arrangements into other states – prescribed by CJEU case law, can be incorporated in the law on PIL,[55] to be considered holistically, with no single factor being decisive.[56]

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[46] Ulrich Magnus, 'Article 6 Rome I' in Ulrich Magnus and Peter Mankowski (eds), ***European Commentaries on Private International Law: Rome I Regulation*** (Sellier 2017) 453–458.

[47] Magnus, U. & Mankowski, P. (2016) European Commentaries on Private International Law: Brussels Ibis Regulation Commentary. Munich: Sellier, pp 443–446.

[48] Parliament of Georgia (2009) Law of Georgia on Public International Law, Article 38.

[49] European Parliament and Council (2008) Regulation (EC) No 593/2008 (Rome I Regulation), art. 6(1).

[50] Magnus, U. (2017) 'Art 6 Rome I', in Magnus, U. & Mankowski, P. (eds) European Commentaries on Private International Law: Rome I Regulation. Munich: Sellier, p. 454.

[51] European Parliament and Council (2008) Regulation (EC) No 593/2008 (Rome I Regulation), art 6(2).

[52] Rühl, G. (2009) 'Consumer Protection in Private International Law: The Limits of Party Autonomy', Yearbook of Private International Law, 10, pp 120–122.

[53] Briggs, A. (2019) Private International Law in English Courts. Oxford: Oxford University Press, pp 710–713.

[54] European Parliament and Council (2008) Regulation (EC) No 593/2008 (Rome I Regulation); European Parliament and Council (2012) Regulation (EU) No 1215/2012 (Brussels Ibis Regulation), art 17(1).

[55] Joined Cases C-585/08 and C-144/09 Pammer v Reederei Schlüter and Hotel Alpenhof v Heller [2010] ECR I-12527.

[56] Magnus, U. (2017) 'Art 6 Rome I', in Magnus, U. & Mankowski, P. (eds) European Commentaries on Private International Law: Rome I Regulation. Munich: Sellier., p. 457.

5.2. Proposals for procedural reforms

All these substantive reforms would be incomplete without corresponding procedural reforms in Georgian civil procedure. Even if Article 38 GPIL were brought into line with Article 6 Rome I, consumers would continue to face significant obstacles if jurisdiction clauses allowed traders to sue them in foreign courts. Brussels Ibis responds to this problem by granting consumers the right to sue in their own domicile and by allowing traders to sue consumers only in that domicile.[57] This asymmetry is deliberate, reflecting the structural inequality between consumers and professionals in cross-border disputes.[58] A Georgian reform that seeks genuine equivalence with EU standards should therefore amend the Civil Procedure Code to adopt an analogous rule: consumers domiciled in Georgia should have the right to bring proceedings either in their own courts or, at their election, in the courts of the trader's domicile, while foreign or domestic traders should be permitted to sue Georgian consumers only in Georgian courts. Moreover, Georgian law should follow the same path provided under Brussels Ibis Article 19; such clauses are valid only if concluded after the dispute has arisen or if they confer additional rights on the consumer.[59] Such rule will provide that pre-dispute jurisdiction clauses designating foreign courts are unenforceable against consumers unless they grant the consumer an option of additional fora. Finally, the reform package should address the role of overriding mandatory rules in Georgian law, confirming that overriding mandatory rules should be construed narrowly and primarily in regulatory fields such as labour law or commercial agency rather than consumer contracts.[60]

In summary, comparative practice supports this direction of travel. Several Central and Eastern European states, including Poland and the Baltic republics, reformed their private international law statutes after accession to the EU by incorporating Rome I and Brussels Ibis concepts almost verbatim, particularly in relation to consumer contracts,[61] enhancing legal certainty, supporting cross-border commerce, and improving the position of consumers without imposing disproportionate burdens on traders.[62] Thus, such reforms would bring Georgian law into line with European standards, fulfil obligations flowing from the Association Agreement, and, most importantly, equip Georgian consumers with meaningful protection in an increasingly complex and borderless marketplace.

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TECHNICAL SCIENCES

PROTECTION OF THE NEUTRAL WIRE FROM ITS BREAKAGE, FROM OVERLOAD CURRENTS AND SHORT-CIRCUIT CURRENTS IN NETWORKS WITH NONLINEAR LOADS

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Abstract

With the appearance of nonlinear loads in networks, problems have arisen with the reliability of neutral wire protections. The 3rd harmonic currents, which are arithmetically added up in the neutral wire, increase its load, so the protection of the neutral wire from overload currents becomes relevant. When constructing such protection, it is necessary to take into account the current of the 3rd harmonic. An increase in the current in the neutral wire leads to the fact that the current in the neutral wire becomes commensurate with the current of a single-phase short circuit. Therefore, The reliability of protection against single-phase short circuits decreases if the undesirable influence of the 3rd harmonic currents is not eliminated. The construction of protection against the break of the neutral conductor and the resulting overvoltages is based on the analysis of the nature of the force function, i.e., the dependence of the change in the sum of the squares of the phase currents over time. The 3rd harmonic currents for this analysis of the force function are an undesirable interference. Thus, when constructing different protections, the values of the effective current values must be measured both taking into account the currents of the 3rd harmonic and without taking them into account. Therefore, an appropriate method has been developed, while it does not use the mathematical apparatus of the discrete Fourier transform, as redundant for switch trippers. This is consistent with the purpose of creating such methods and algorithm for constructing protections that are based on the analysis of current values measured by the methods adopted in the construction of current protections. This allows the algorithm for the construction of such protections, together with the maximum current protections, to be implemented in the circuit breaker trips. In this case, the infrastructure of protection of electric networks is significantly reduced.

Keywords: Neutral wire protection, force function, current harmonics.

1. ***Introduction***.

As a result of the appearance of non-linear loads (computer, etc.) in three-phase networks, additional problems may arise with the protection of the neutral wire (N-wires). Before considering these problems and the proposed ways to solve them, we will briefly point out the existing problems with protection - N −wires at linear loads.

There are various ways to protect against N −wire breakage and the resulting overvoltages. To build a protection against the break of the neutral wire, the analysis of the value of the reverse sequence current has recently been used. Measuring transducers are used to determine the current value. They contain differentiating induction measuring current transducers, as well as a reverse sequence voltage filter. Therefore, it is very difficult to implement such protection in a microprocessor-based circuit breaker trip. Therefore, protection against the break of the N-wire based on the analysis of the reverse sequence current is implemented in special devices. According to [1], the analysis of the reverse sequence current is implemented, for example, in the BMRZ-102 units (R&D Center "Mechatronics") and the MiCOM P126 relay (Schneider Electric). When using the above and other similar devices, the circuit breaker trip is used only as an actuator element for disconnecting the network when a control signal arrives at it. The above method of protection against breakage N wires and overvoltages - provides for a significant increase in the infrastructure of the network protection system. At the same time, the circuit breakers in this system, in addition to current protection, perform only the function of an actuator. In order for the circuit breakers to also perform the functions of protection against N −wire breakage and the resulting overvoltages, it is necessary that the algorithm of such protections can be implemented in the microprocessor unit of the circuit breaker trip. To do this, it is necessary that only information from current sensors included in the circuit breakers is sufficient to construct these protections.

The paper presents [2] method for constructing protections against N-wire breakage and the resulting overvoltages based on the analysis of the force function of the electric network. This function $F_s(t)$ is the dependence of the change in time of the sum of squares of phase currents. This means that for the construction of N - wire protections, information only from current sensors is sufficient, and therefore the algorithm for constructing such protections can be implemented in a trip unit switch.

The construction of the protection against the breakage N of the wire is based on the analysis of the nature of the force function in $F_s(t)$ the steady state. The analytic expression of a function $F_s\,(t)$ is defined by the following expression:

$$F_s\,(t) = [i_a(t)]^2 + [i_b(t)]^2 + [i_c(t)]^2 \quad (1)$$

where $i_a(t), i_b(t)$ and $i_c(t)$ - are the dependencies of the change in time of phase currents.

If the moduli of the phase currents are the same and equal to the phase value I_f ($I_a = I_b = I_c = I_f$), then the expression of the force function of the network without nonlinear loads $F_s\,(t)$ will be as follows:

$$F_s(t) = = 3I_f^2 + \left[I_f^2 \cos 2\omega t + I_f^2 \cos 2(\omega t - 2\pi/3) + I_f^2 \cos 2(\omega t + 2\pi/3)\right] = F_{sd}(t) + F_{sa}(t) \quad (2),$$

where $F_{sd}(t)$ is the constant of the component, and the $F_{sa}(t)$ variable of the component.

As follows from expression (2), if in addition to the equality of the modules of phase currents, the equality of angles between the vectors of phase currents is also preserved, then the variable component $F_{sa}(t)$ will be equal to zero. This property of the force function makes it possible to use its analysis to determine the absence or presence of a break N in the wire. For example, if in the current system of a real network the modules of phase currents are made equal in value - with the help of equalization coefficients ($I'_a = I'_b = I'_c$), then in the absence of an open N wire, the variable component of the force function of such a transformed network $F'_{sa}(t)$ will be equal to zero. And in case of a break in the N- wire, when the angles between the vectors of the phase currents are no longer the same and equal to 2π/3, a variable component will appear $F'_{sa}(t)$ and its value will characterize the value of the overvoltage. The considered в [2] method of constructing protection against open N-wires refers to the case of the absence of higher current harmonics in the network. In the presence of higher current harmonics, in particular, currents of the 3rd harmonic, it is necessary to take into account their influence on the reliability of protection. This requires an appropriate method of analyzing the force function.

3rd harmonic currents also affect the reliability of protection against single-phase short-circuit currents and overload currents. After all, the summation of the 3rd harmonic currents of all phases in the wire leads to a situation in which the value of the current in the N - wire becomes commensurate with the possible values of single-phase short-circuit currents. But when constructing a N-wire protection against overload currents, 3-harmonic currents must be taken into account. Thus, there is a problem of developing a method for selectively determining the effective current values – in some cases it is necessary not to take into account 3-harmonic currents, and in others to take into account. Taking into account the above, the main goal of this work was to create *N*-wire protections in networks with nonlinear loads based on the analysis of only information from the circuit breaker current sensors. This makes it possible to implement protection algorithms in microprocessor-based circuit breaker trips. To achieve this goal, the task was set to develop a method for determining the values of the 1st and 3rd harmonic currents without using the well-known discrete Fourier transform apparatus, as it is excessive for circuit breaker releases.

It was also necessary to develop methods for constructing reliable protection against currents of single-phase short-circuits by eliminating undesirable interference from 3rd harmonic currents based on the analysis of the force function, in which the influence of 3rd harmonic currents on the reliability of protection should be excluded.

2. Main results

2.1 Method for determining the values of the effective values of the currents of the 1st and 3rd harmonics

One of the possible methods that make it possible to determine the effective values of the effective values of the currents of higher harmonics is the mathematical apparatus of Fourier decomposition. This method makes it possible to determine the values of currents of different harmonics, in particular, currents of the 1st and 3rd harmonics. However, in the current protections that are used in the circuit breaker trips, this mathematical apparatus is not used. Therefore, a method for determining the values of the effective values of the currents of the 1st and 3rd harmonics was developed, which uses the methods for determining the effective current values accepted for current protection.

The method for determining the effective value of the currents of the 1st and 3rd harmonics is based on the consequence of failure to meet the requirements of the Nyquist-Shannon-Kotelnikov theorem [3] and [4]. According to the specified requirements of the theorem, the sampling rate of the analog signal should be at least 2 times higher than the frequency f_3 of the 3rd harmonic. If the time range of sampling is limited to a single period of current variation, then the sampling rate should be used at 3 times the frequency f_3 of the 3rd harmonic current. If the requirement of this theorem on the sampling rate is not met, the $f_д$consequence will be an inevitable distortion of the value of the third-harmonic current in the total phase current. Therefore, it seems productive to deliberately choose such a sampling rate at which the distortion of the value of the third harmonic current, in the direction of its decrease, will be the maximum possible, namely, equal to zero. Such a sampling rate, as will be shown below, is the frequency of the current of the 3rd harmonic, the value of which is equal to f_3=150 Hz.

Let us consider the case when, with continuous monitoring of the effective current value, the beginning of the discrete current values i_j occurs at the moment when the 3rd harmonic current passes through the zero value At a sampling rate equal to the 3rd harmonic current frequency ($f_д$=$f_3 = 150\ Hz$) all discrete current values $i_j$will not contain the 3rd harmonic current. This means that the measured value of the effective current will be minimal I_{min} and equal to the current of the first harmonic:

$$I_{min} = I_1 \quad (3)$$

Now let's consider a case in which the discrete values of the dependence $i(t)$ will start at the time of the passage of the 3rd harmonic current through its maximum value $\sqrt{2}I_3$. In this case, all discrete values of the 3rd harmonic current i_j will be the same and equal $\sqrt{2}I_3$ .Therefore, in this case, the measured value of the effective current value will be the maximum I_{max} and is determined by the expression:

$$I_{max} = \sqrt{I_1^2 + 2I_3^2} \quad (4)$$

Thus, with continuous monitoring of the value of the effective value of the current, we obtain the dependence $I = f(t)$, in which the value of the current changes from its minimum value I_{min} to the maximum I_{max} . From the result of monitoring the values of the effective value of the current, we can determine the value of the current of the 1st harmonic by expression (3). It should

be noted that in order to ensure sufficient accuracy in determining the extreme values of the effective current values I_{min} *and* I_{max}, the time interval between the next readings of discrete current values should be sufficiently small. The value of the specified time interval should correspond to the slip frequency f_s, which significantly exceeds the frequency of the current of the 3rd harmonic, for example, f_s=1500 Hz.

Now let's consider how the results of monitoring the values of the effective current value can be used to determine the value of the 3rd harmonic current.

The maximum effective value of the current I_{max}, as shown earlier, is determined by the expression (4). Given that =$I_{min} = I_1$, consider the sum of the squares I_{max}^2 and I_{min}^2:

$$I_{max}^2 + I_{min}^2 = 2I_1^2 + 2I_3^2 \quad (5)$$

It follows from equation (4) that the effective value of the current taking into account the currents of the 1st and 3rd harmonics $I_{(1+3)}$ will be determined by the following expression:

$$I_{(1+3)} = \sqrt{0{,}5(I_{max}^2 + I_{min}^2)} \quad (6)$$

Thus, the value at the root of half of the sum of the squares of the extreme values of the effective current value is indeed the value of the current taking into account the currents of the 1st and 3rd harmonics.

If the value of the 1st harmonic current I_1 is known as $I_1 = I_{min}$, then from equation (4) we obtain that the value of the 3rd harmonic current I_3 will be determined by the following expression:

$$I_3 = \sqrt{I^2{}_{(1+3)} - I^2{}_{min}} = \sqrt{0{,}5(I^2{}_{max} - I^2{}_{min})} \quad (7)$$

The obtained expressions (2), (6) and (7) to determine the effective values of currents in the 1st and 3rd harmonics, as well as their sums, can be used in the construction of different types of protection *N*-wires.

It should be noted that in the considered method for determining the values of the 1st and 3rd harmonic currents, methods for determining the effective current values used in the construction of current protections are used. Therefore, the considered technique can be implemented in the circuit breaker trip.

2.2. Methods for constructing various types of protection – wires *N*

2.2.1. Construction of protection against wire breakage N and emerging overvoltages

When constructing a protection against N-wire breakage in a network without nonlinear loads [2] a real system of phase currents is converted into a system with identical modules of phase current vectors. Since in networks with nonlinear loads, 3rd harmonic currents do not affect overvoltages when the *N*-wire is broken, it is sufficient to equalize only the values of the effective values of the 1st harmonic currents. For this purpose, the expression (3) is used to find the value of the effective value of the 1st harmonic current. After the values of the 1st harmonic currents in the phases are determined, the equalization coefficients are determined K_{1a}, K_{1b} and K_{1c}.

Then, with the help of equalization coefficients, a transformed current system is formed, in which the values of the phase currents of the 1st harmonic are the same.

In such a converted current system, if there is no break in the *N*-wire, the variable component $F'_{sa}(t)$, will be present as part of the force function $F'_s(t)$, due to 3rd harmonic currents. There fore, in order to construct the protection of the *N*-wire in the absence of its breakage, it is necessary to analyze not the nature of the entire force function, but only the envelope line of the minimum values of the force function. This envelope line does not contain the values of the 3rd harmonic current. And since the values of the effective values of the 1st harmonic currents are the same ($I'_{1a} = I'_{1b} = I'_{1c}$), the envelope curve of the minimum values of the force function F'_{min} is the dependence of $F'_{min} = f(t)$ is essentially a constant component of the force function for the 1st harmonic currents $F_{sd}(t) = 3I_1^2$. Thus, the criterion for the absence of an *N*- wire break is the constancy in the value of the dependence $F'_{min} = f(t)$.

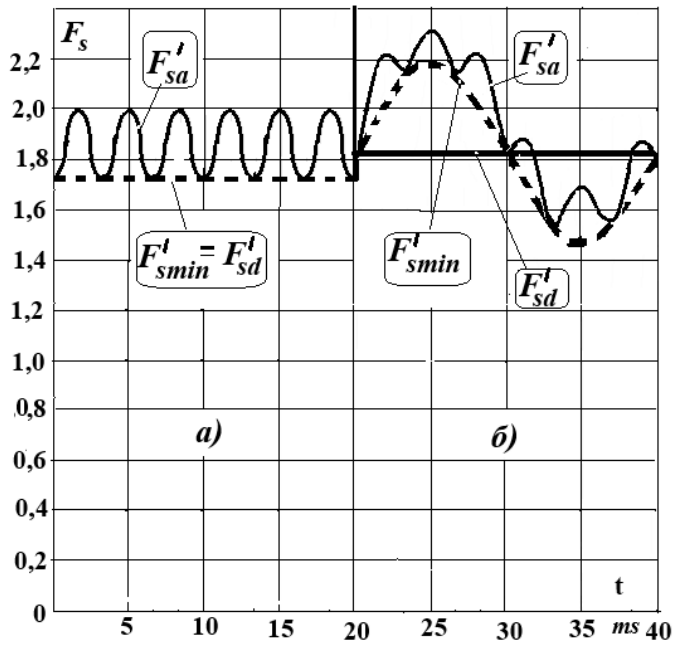

Fig.1 Nature of the force function of the reduced current system before and after N- wire break

Fig.1a shows the nature of the force function and its component for the case when the value of the 3rd harmonic current is 43% of the value of the 1st harmonic current. As can be seen from Fig. 1 a$F_s(t)$ $F_{sd}(t)F_{sa}(t)$, the minimum value of the force function F'_{smin} does not take into account the currents of the 3rd harmonic. Therefore, the value F'_{smin} in the absence of an *N*-wire break turns out to be equal to the value of the constant component of the force function F'_{sd}.

Now let's consider what nature the force function will have in the event of an *N*-wire break. For example, in the case when two power feeders of apartment buildings are connected to the line, and the break in the *N*-wire occurred at the entrance of the main panel of one of the houses. In this case, the force function of the converted current system $F'_s(t)$ will contain the variable component $F'_{sa}(t)$. This component is due to both the 3rd harmonic currents of the undamaged part of the network, and the non-symmetry of the 1st harmonic currents of the damaged part of the network.

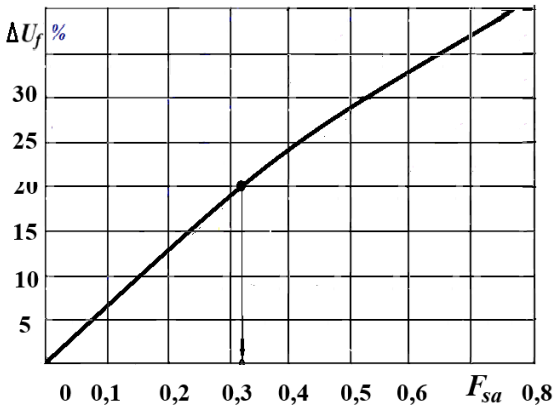

Fig.2 Dependence of the value of overvoltage ΔU_f on the value of the variable component of the force function F_{sa}

Fig.1b shows a graph of the force function for the case of a partial break the *N*-wire. As can be seen from the graph, in addition to the constant component F'_{sd}, the force function includes the variable component caused by the currents of the 1st and 3rd harmonics. The variable components of the force function, which change with the frequencies of the currents of the 1st and 3rd harmonics, change over time from their minimum values to the maximum. At the same time, in the envelope line of the minimum values of the force function $F'_{min} = f(t)$, depending on the values of the 3rd

harmonic currents $F'_{s1}(t)$, will not be taken into account. Therefore, the results of the dependency analysis $F'_{min} = f(t)$ for networks with nonlinear loads are identical to the analysis of the force function for networks without nonlinear loads. Fig.2 shows the dependence obtained from the results of a machine experiment $\Delta U_f = f(F_{sa})$ for networks without higher harmonics. The value of the variable component F_{sa} is presented in relative units to the value of the constant component $F_{sd} = 3I_f^2$. The experiments were carried out for the most dangerous combination of phase loads $Z_a > (Z_b = Z_c)$ from the point of view of the value of overvoltage. As the calculations showed, if $F_{sa} \geq 0.32$, then the overvoltage value $F_{sd}\,\Delta U_f$ will be more than $0.2, U_f$ so the network should be disconnected in 15 seconds.

Thus, the criterion for the occurrence of an *N*-wire break is the change over time in the dependence of the minimum value of the force function $F'_{min} = f(t)$, which is the force function of the 1st harmonic currents. At the same time, the value of the effective value of the time component of the specified force function characterizes the overvoltages in the phases when the N-wire is broken $F'_1 = f(t)$. At the same time, the value of the effective value of F'_{sa} the time component of the specified force function characterizes the overvoltages in the phases when the N-wire is broken, which can be determined from the dependence $\Delta U_f = f(F_{sa})$.

Summing up, let's formulate the essence of the algorithm for implementing protection against *N*-wire breakage. First, the values of the 1st harmonic currents in the phases are determined using the method for determining the values of the 1st and 3rd harmonic currents. After that, the equalization coefficients for the 1st harmonic currents are determined, and with their help the values of the effective values of the currents of all three phases of the converted network are determined. determine the dependencies of the change in time of currents in each of the phases of the transformed current system - $i'_a(t)$, $i'_b(t)$ and $i'_c(t)$. After that, the force function of the converted current system $F'_s(t)$ and its components - $F'_{sd}(t)$ and $F'_{sa}(t)$. After that, the nature of the envelope curve of the minimum values of the force function - F'_{min} dependence $F'_{min} = f(t)$ is analyzed. If the instantaneous values F'_{min} do not change with time, then it is concluded that there is no break in the *N*-wire. If the values F'_{min} of the change over time, then it is concluded that there is break a the *N*-wire. Since the dependence $F'_{min} = f(t)$is a variable component of the force function of the currents of the 1st harmonic $F'_1 = f(t)$, then the value of the effective value of the variable component of this function $F'_{sa} = F'_1$, determines the value of the expected overvoltage ΔU.

2.2.2. Construction of protection N–wires against overload currents.

First, based on the instantaneous values of currents i_j in phases a, b, and c, the dependence of the current in the N-wire on time is determined-the dependence $i_N = f(t)$. Then, from the analysis of the dependence $i_N = f(t)$, in accordance with the method for determining the values of the 1st and 3rd harmonic currents, the dependence of the change over time of the effective value of the current in the N-wire is determined – the dependence $I_N = f(t)$.

From the dependence $I_N = f(t)$, the extreme values of the current are determined – the values I_{Nmin} and I_{Nmax} and the effective current value in the N-wire, taking into account the 1st and 3rd harmonic currents, using the expression $I_{N(1+3)} = \sqrt{0{,}5(I_{Nmax}^2 + I_{Nmin}^2)}$. After that, the current value $I_{N(1+3)}$ is compared with the overload current setting value I_{sd}, and if $I_{N(1+3)} \geq I_{sd}$, a control signal is generated.

2.2.3. Construction of protection for N-wires of single-phase short circuits

Based on the sum of instantaneous current values i_j in phases a, b, and c, the dependence of the current value in the *N*-wire on time is determined – the dependence $i_N = f(t)$. Then, from the analysis of the dependence $i_N = f(t)$, the dependence of the change in the effective current value in the *N*-wire over time is determined – the dependence $I_N = f(t)$. After that, the minimum current value I_{Nmin} is determined. Then, the 1st harmonic current value is determined as $I_{N1} = I_{Nmin}$ and compared with the short-circuit current setting value I_{kz}. If $I_{N1} \geq I_{kz}$, a control signal is generated by the control element IE to activate the protection.

Algorithm of the microprocessor release operation when constructing *N*-wire protection

The algorithm of the microprocessor release operation for implementing *N*-wire protection against breakage, short-circuit currents, and breakage is shown in Fig. 3. The mathematical operations of the algorithm are presented in the form of modules, but they do not physically exist.

N-wire protection channel against breakage and resulting overvoltages

The basis of the *N*-wire break protection algorithm is the analysis of the force function. Such an analysis can be performed by continuously monitoring the current during the time interval Δt between readings of discrete current values. In this case, the microprocessor's performance must be sufficiently high.

Force analysis is possible in a repetitive short-term mode of operation, in which, in the first time interval *(Δt = 20 ms*), measurements are made and current values are stored in memory during the first period, and in the second time interval, the force function is analyzed.

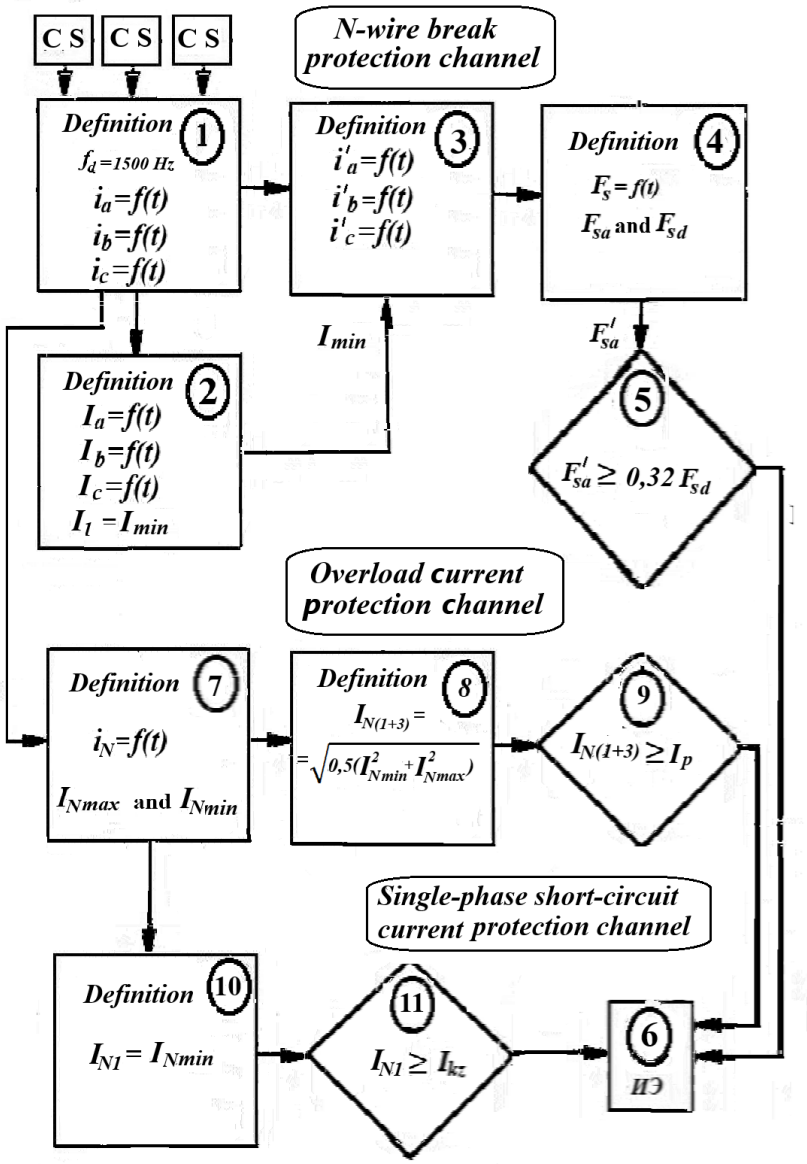

Fig.3 Algorithm for constructing protections against N-wire breakage, overload currents and single-phase short-circuit

In module 1, from analog signals from current sensors with a sampling frequency significantly higher than the frequency of the third harmonic current (for example, $f_s = 1500$Hz), the dependencies of the instantaneous values of phase currents on time are determined. The obtained dependencies $i_a = f(t)$, $I_b = f(t)$ и $i_c = f(t)$ are stored in the microprocessor memory.

In module 2, from the dependencies $i_a = f(t)$, $i_b = f(t)$ и $i_c = f(t)$, the effective values of the phase currents are determined at each slip step Δt_s, corresponding to the slip frequency $f_s = 1500$ *Hz*. The discrete current values are determined with a sampling frequency of $f_d = 150$ Hz. In the same module, the dependence of the change in the effective values of the phase currents is determined—the dependencies $I_a = f(t)$, $I_b = f(t)$ and $I_c = f(t)$. From these dependencies, the extreme values of currents in each of their phases are determined - the values I_{min} and I_{max}. In the same module, from the found values I_{min} and I_{max}, the effective values of the 1st harmonic currents are determined from the expression $I_1 = I_{min}\}$. In the same module, based on the found values of the 1st harmonic currents in each phase—the values I_{1a} and I_{3a}, I_{1b} and I_{3b}, I_{1c} and I_{3c}, the equalization coefficients for the 1st harmonic phase currents are determined K_{1a}, K_{1b} and $K_{1,c}$.

In Module 3, the initial dependencies of the phase currents -$i_a(t)$, $i_b(t)$ and $i_c(t)$ on time are multiplied by the equalization coefficients K_{1a} , K_{1b} and K_{1c} . This determines the converted dependencies of the phase currents of the reduced current system over time – dependencies - $i'_a(t)$, $i'_b(t)$ and $i'_c(t)$

In module 4, the force function $F'_s(t)$ is determined for the converted current system - $i'_a(t)$, $i'_b(t)$ and $i'_c(t)$. In the same module, the dependencies of the

constant component of the force function $F'_{sd}(t)$ and the variable component $F'_{sa}(t)$ on time are determined.

In module 5, the value F'_{sa} is compared with the permissible value, and if $F'_{sa} \geq 0{,}32F'_{sd}$, a "Yes" signal is generated and sent to module 6 (the executive element).

N-wire overload current protection channel.

In module 7, the dependencies $i_a = f(t)$, $I_b = f(t)$ and $i_c = f(t)$ obtained in module 1 are used to determine the dependence of the current in the *N*-wire $_i_N = f(t)$ on time. From the dependence $i_N = f(t)$, the dependence зависимость $I_N = f(t)$ and the extreme values of the effective current – the values I_{Nmin} and I_{Nmax} – are determined.

In module 8, from the found values II_{Nmin} and I_{Nmax}, the effective value of the current in the *N*-wire is determined, taking into account the 1st and 3rd harmonic currents, using the expression $I_{N(1+3)} = \sqrt{0{,}5(I^2_{Nmax} + I^2_{Nmin})}$

In module 9, the current value $I_{N(1+3)}$is compared with the overload current setting value I_{sd}. If $I_{N(1+3)} \geq I_{sd}$, a control signal is generated by the actuator IE of module 6 to activate the protection.

Single-phase short-circuit current protection channel

In module 10, the effective values of the 1st harmonic currents are determined from the expression $\mathrm{I_{N1}} = \mathrm{I_{Nmin}}$

In module 11, the current value $\mathrm{I_{N1}}$ is compared with the short-circuit current setting value $\mathrm{I_{kz}}$. If $\mathrm{I_{N1}} \geq \mathrm{I_{kz}}$, a control signal is generated by the actuator IE of module 6 to activate the protection

3. Summary

The task of creating N-wire protections in networks with nonlinear loads based solely on the analysis of information from current sensors has been solved. The peculiarities of the flow of 3rd harmonic currents in networks with nonlinear loads make it necessary, when constructing various protections for N-wires, to take into account 3rd harmonic currents in some cases and not to take them into account in others. To this end, a method has been developed for determining the magnitude of 1st and 3rd harmonic currents without using the well-known discrete Fourier transform, which is excessive for circuit breaker releases. This method forms the basis for the construction of N-wire protection. Thus, when designing protection against overload currents, the current value is analyzed taking into account the 1st and 3rd harmonic currents, and when designing protection against single-phase short circuits, the current value is analyzed without taking into account the 3rd harmonic current.

The basis for constructing protection against N-wire breakage and resulting overvoltages is an analysis of the force function of the transformed current system, in which the effective values of the 1st harmonic currents of all phases are made equal by means of equalization coefficients. The force function of such a current system generally contains a constant and a variable component. An important factor in the design of N-wire protection is that the composition of the force function depends on the state of the wire. If there is no N-wire break, then only a constant component exists in the composition of the force function. When the N-wire breaks, an alternating component also arises, the magnitude of which determines the magnitude of the overvoltage.

All of the N-wire protections considered are based on the analysis of data from current sensors only, and the same methods used in the construction of current protections are used to measure current values. This allows, as stated in the objectives of the work, the algorithm for constructing neutral wire protections to be implemented, together with maximum current protections, in circuit breaker releases. In this case, the infrastructure of electrical network protections is significantly reduced.

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